

JANUARY, 1947

# Railway Engineering Maintenance

*WHEN  
WINTER,  
COMES*

THOUGH HIDDEN FROM VIEW BY  
SNOW AND ICE, THE IMPROVED FAIR  
ANCHOR SECURELY GRIPS THE RAIL,  
ASSURING DEPENDABLE AND EFFECTIVE  
PROTECTION UNDER SEVERE CONDITIONS.



SOUTHERN PACIFIC RY. NEAR CRESCENT LAKE, OREGON

CHICAGO • NEW YORK • DENVER  
WASHINGTON • ST. LOUIS

THE PACIFIC

CLEVELAND • ST. PAUL  
BOSTON • SAN FRANCISCO

# TENSION

THERE ..... IN SPITE OF WEAR

Reliance Hy-Pressure Hy-Crome Spring Washers maintain that all important bolt tension in rail joint assemblies by automatically compensating for inevitable looseness resulting from wear.

Tension There In Spite Of Wear with Reliance Hy-Pressure Hy-Crome Spring Washers lessens the danger of loose rail joint assemblies and reduces maintenance costs.



Write Today for six page folder on Reliance Hy-Crome Spring Washers for track and find out how Reliance Hy-Pressure Hy-Crome Spring Washers can meet your toughest assignment.



## EATON

EATON MANUFACTURING COMPANY

MASSILLON, OHIO

# Reliance Division

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

# MAINTENANCE MEN

## LOVE DATES LIKE THESE....

They show years of dependable rust prevention, under conditions that accelerate corrosion. One coat application of NO-OX-ID invariably does the trick. NO-OX-ID can be brushed on over existing rust and scale. It penetrates down to the parent metal, where it stops further corrosion. Rust scale will loosen under NO-OX-ID's chemical action, base areas may appear, exposing parent metal. All that is required is touching up of these patches. With this easy effective application, NO-OX-ID saves up to 50% of ordinary maintenance cost.

LONG-TIME DEPENDABLE PROTECTION

AGAINST CORROSION...

PAINTED  
1 COAT  
NO-OX-ID BLACK FILLER  
AUG 1935

PAINTED  
1 COAT  
NO-OX-ID BLACK FILLER  
JULY 1935

PAINTED  
1-COAT  
DECK ONLY  
NO-OX-ID  
AUG-14-1934

PAINTED  
ONE COAT  
NO-OX-ID BLACK FILLER  
JUNE 1935

PAINTED 5-4-35  
NO-OX-ID A SPECIAL

NO-OX-ID  
IRON. OX. ID  
RUST

REG. TRADEMARK  
AUG 27, 1918

## The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company  
Dept. U, 310 S. Michigan Ave., Chicago 4, Ill.  
New York • Los Angeles • Toronto

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, \$2.00 for one year; \$3.00 for two years. Single copies 50 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.



# Cut Roadbed Maintenance Costs

**STABILIZE WITH LONG-LASTING  
ASPHALT-CEMENT  
PRESSURE GROUTING**

**S**AVINGS of as much as 80% in roadbed maintenance have been reported after stabilization with asphalt-cement pressure grouting — using *Texaco No. 24 Emulsified Asphalt* developed especially for this work.

*Texaco No. 24 Emulsified Asphalt* improves ordinary cement grouting mixtures by: 1) promoting easier flow; 2) assuring better penetration and seal; and 3) permitting use of leaner, more economical mixtures. Then, too, the addition of asphalt helps to waterproof the soil and keep it resilient and stable.

Asphalt-cement pressure grouting quickly pays for itself. In addition to the remarkable savings in first cost and maintenance, slow orders and other expensive operating restrictions are eliminated . . . and the work can be done quickly without interrupting traffic. Results are lastingly effective.

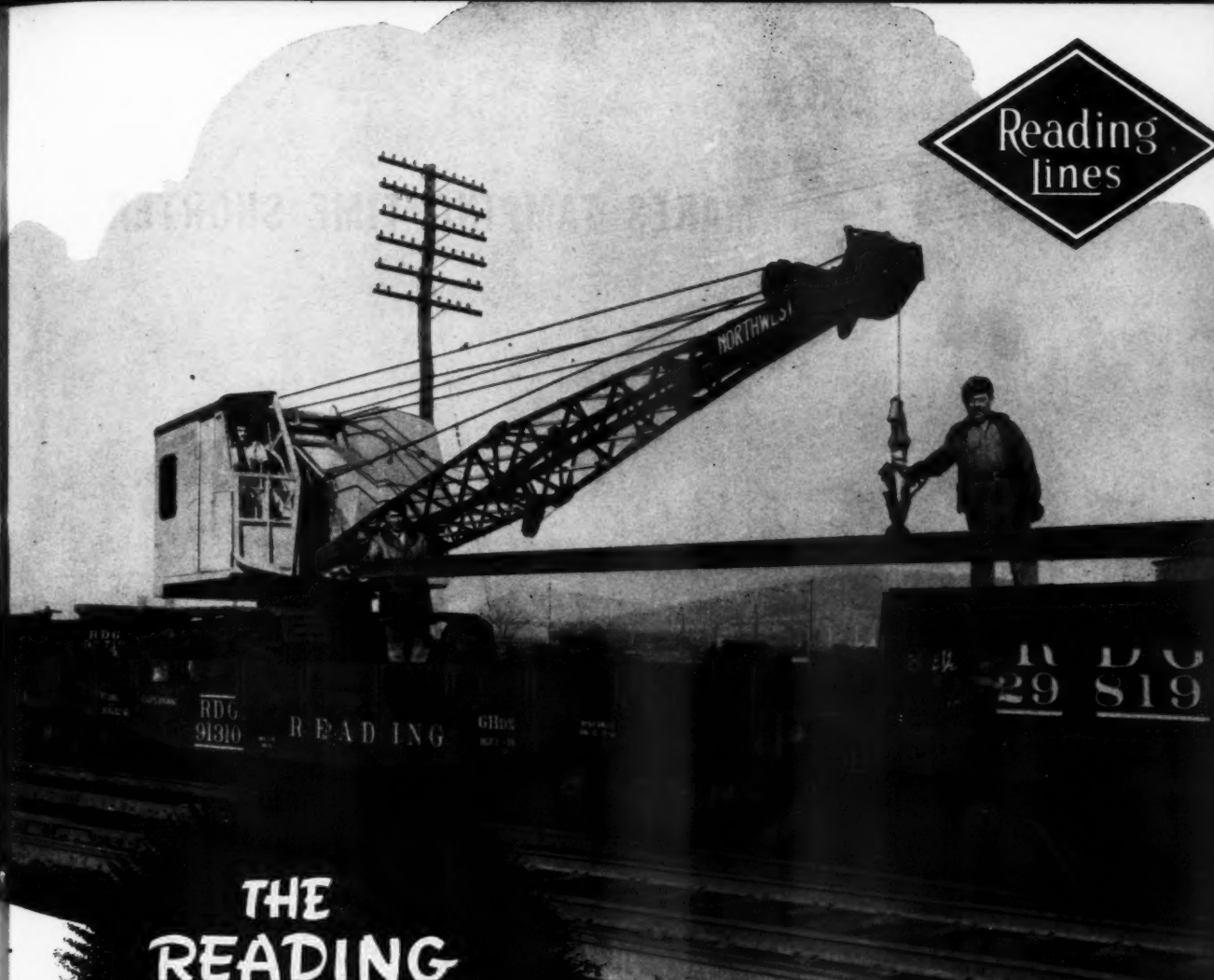
For complete information on asphalt-cement pressure grouting — methods, costs, results — call the nearest Railway Sales Division Office listed below, or write The Texas Company, *Railway Sales Division*, 135 East 42nd Street, New York 17, New York.

NEW YORK • CHICAGO • SAN FRANCISCO • ST. PAUL • ST. LOUIS • ATLANTA



## TEXACO Emulsified Asphalt FOR GROUTING

Tune in . . . TEXACO STAR THEATRE presents the NEW EDDIE BRACKEN SHOW every Sunday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.



Reading  
lines

THE  
READING  
COMPANY  
*buys a  
fifth*

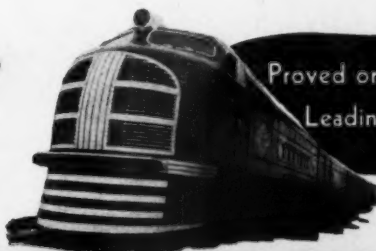
**NORTHWEST**

NORTHWEST  
ENGINEERING COMPANY  
1713 Steger Building, 28 East Jackson Boulevard  
Chicago 4, Illinois

**H**ERE is another of the many Class 1 Railroads that has proved its satisfaction in Northwest performance by a repeat order purchase of Northwest equipment.

**NORTHWEST**

THE ALL PURPOSE RAILROAD MACHINE  
SHOVEL • CRANE • DRAGLINE • PULLSHOVEL



Proved on the Nation's  
Leading Railways



**MAKES TAMPING TIME SHORTER**

**KEEPS MEN  
WITH YOU LONGER**

Self-contained, lightweight, easily-operated Barco Unit Tytampers are handling more and more track jobs in faster time than ever before. Maintenance men pick Barco not only for its speed and economy, but also because it is easier to obtain and hold workers on Barco-equipped roads. For more and better tamping per shift, for fewer labor problems, put Barco on the job.

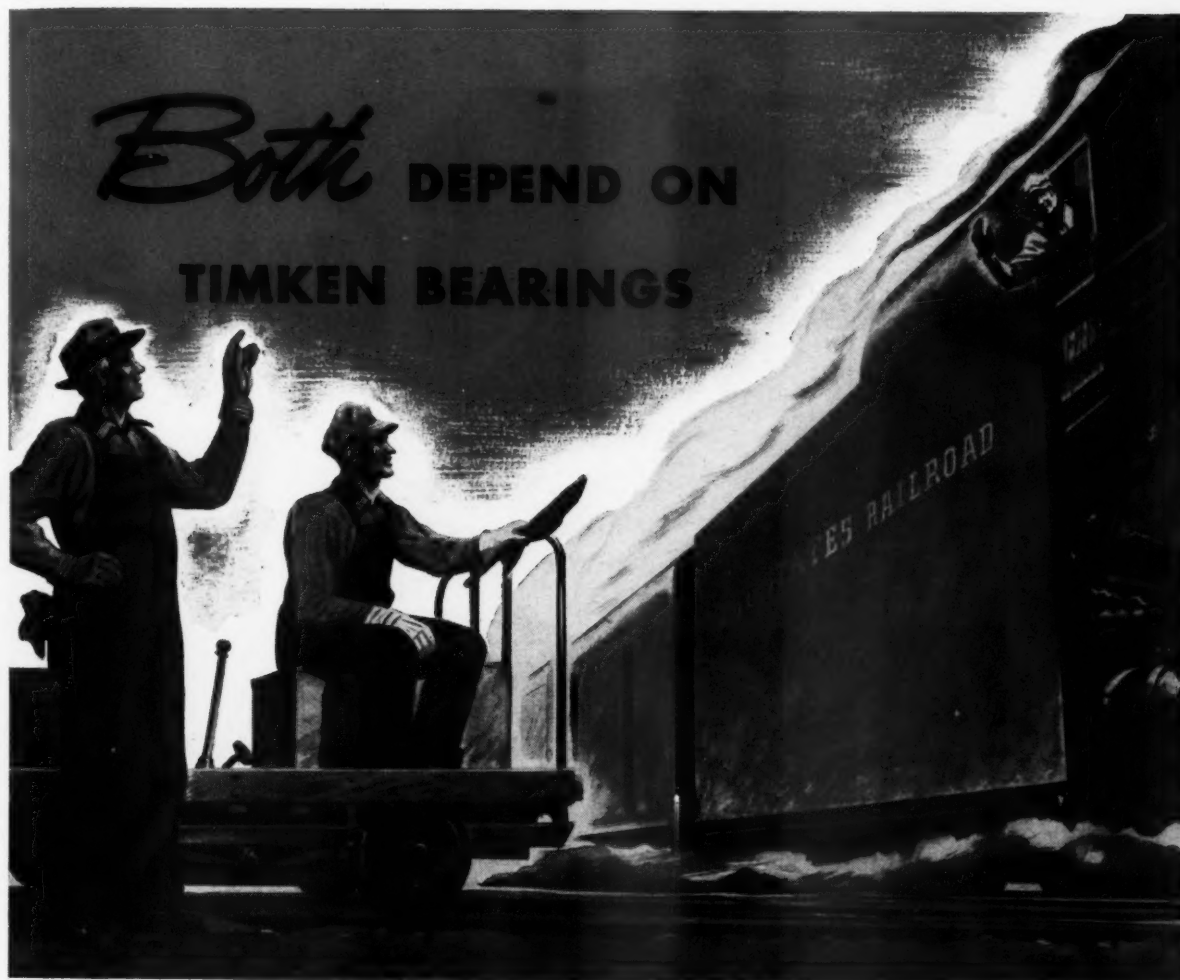
**BARCO**  
**UNIT TYTAMPERS**

**FREE ENTERPRISE—THE CORNERSTONE  
OF AMERICAN PROSPERITY**

**BARCO MANUFACTURING CO., NOT INC.**

**1805 Winnemac Avenue, Chicago 40, Illinois**

**In Canada: The Holden Company, Ltd., Montreal, Canada**



# Both **DEPEND ON** **TIMKEN BEARINGS**

Main line and auxiliary equipment of all kinds using Timken Roller Bearings have these advantages in common: constant availability for service; ability to keep going for maximum periods without shopping; minimum attention for lubrication and maintenance.

American railroads use Timken Bearings in locomotives, passenger cars and streamlined trains to enable them to operate heavier trains on faster schedules.

They use Timken Bearing Equipped section motor cars to help maintain their tracks in sound, safe condition at all

times. When buying new section cars of any type it will pay you to ask this question: "Are they equipped with Timken Bearings?" If you are a car builder, look for the trade-mark "TIMKEN" on every bearing you install. The Timken Roller Bearing Company, Canton 6, Ohio.

**48** Years of Engineering and Metallurgical Development  
Railway Engineering and Maintenance





## 36 Years of Railroad Weed Control Service . . .

That's your assurance of:

- Dependable chemicals.
- Common sense analysis of your weed problem.
- Workmanlike equipment.
- Nationwide facilities.

Now is the time to plan your 1947 weed control program. Call on us to help you . . . we can recommend and provide the right chemical weed killer to suit your condition.

### CHIPMAN CHEMICAL COMPANY, Inc.

Chicago, Ill. Houston, Tex. Palo Alto, Calif. Bound Brook, N. J. Portland, Ore. No. Kansas City, Mo.

*Manufacturers of*

**ATLACIDE**  
CHLORATE WEED KILLER

and

**ATLAS "A"**  
ARSENICAL

also Chipman 2,4-D Weed Killer and CHLORAX Weed Killer

THE FAMOUS

*Red Elastic  
Collar*

IS A SYMBOL OF  
SECURITY



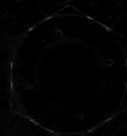
*It makes ESNA Elastic Stop Nuts  
Self-Locking, Self-Sealing and Reusable*

As a result, all ESNA Elastic Stop Nuts protect assemblies against the effects of: **VIBRATION:** Elastic Stop Nuts lock in position anywhere on a bolt or stud. Vibration, impact or stress reversal cannot disturb prestressed or positioned settings. . . . **CORROSION:** Elastic Stop Nuts keep the working threads on the bolt and nut bright and rust-free to protect their strength and permit easy removal without damage to the bolt. . . . **THREAD FAILURE:** Elastic Stop Nuts dampen impact stresses and materially reduce the shocks against bolt threads that frequently cause metal fatigue. . . . **LIQUID SEEPAGE:** Elastic Stop Nuts produce a radial-reactive pressure against

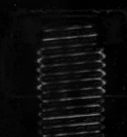
the bolt threads inside the Red Elastic Collar that makes Elastic Stop Nuts self-sealing against liquid seepage. . . . **COSTLY MAINTENANCE:** Elastic Stop Nuts are reusable. (Torque tests on aircraft bolts prove that adequate locking torque is maintained through 15 on-and-off cycles.) They do not deform the bolt, damage the threads, gall the finish, or rust.

This wide range of protection permits full purchasing and inventory standardization and its resultant economy. For further information address: Elastic Stop Nut Corporation of America, Union, New Jersey. Sales Engineers and Distributors are conveniently located in many principal cities.

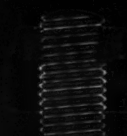
The RED ELASTIC COLLAR is . . .



**PERMANENTLY CLINCHED** to prevent turning under application and subsequent operational stresses.



**PERMANENTLY SECURE** against vibration effects. The bolt impresses (does not cut) full contact threads.



**PERMANENTLY TIGHT** against moisture. Bolt threads have 100% contact in collar—and a full metal seat.



**REUSABLE.** The Red Elastic Collar retains its grip after repeated usage.

**ESNA ELASTIC STOP NUTS**

TRADE MARK



INTERNAL  
WRENCHING



ANCHOR



WING



SPLINE



CLINCH



GANG  
CHANNEL



CAP

PRODUCTS OF: ELASTIC STOP NUT CORPORATION OF AMERICA

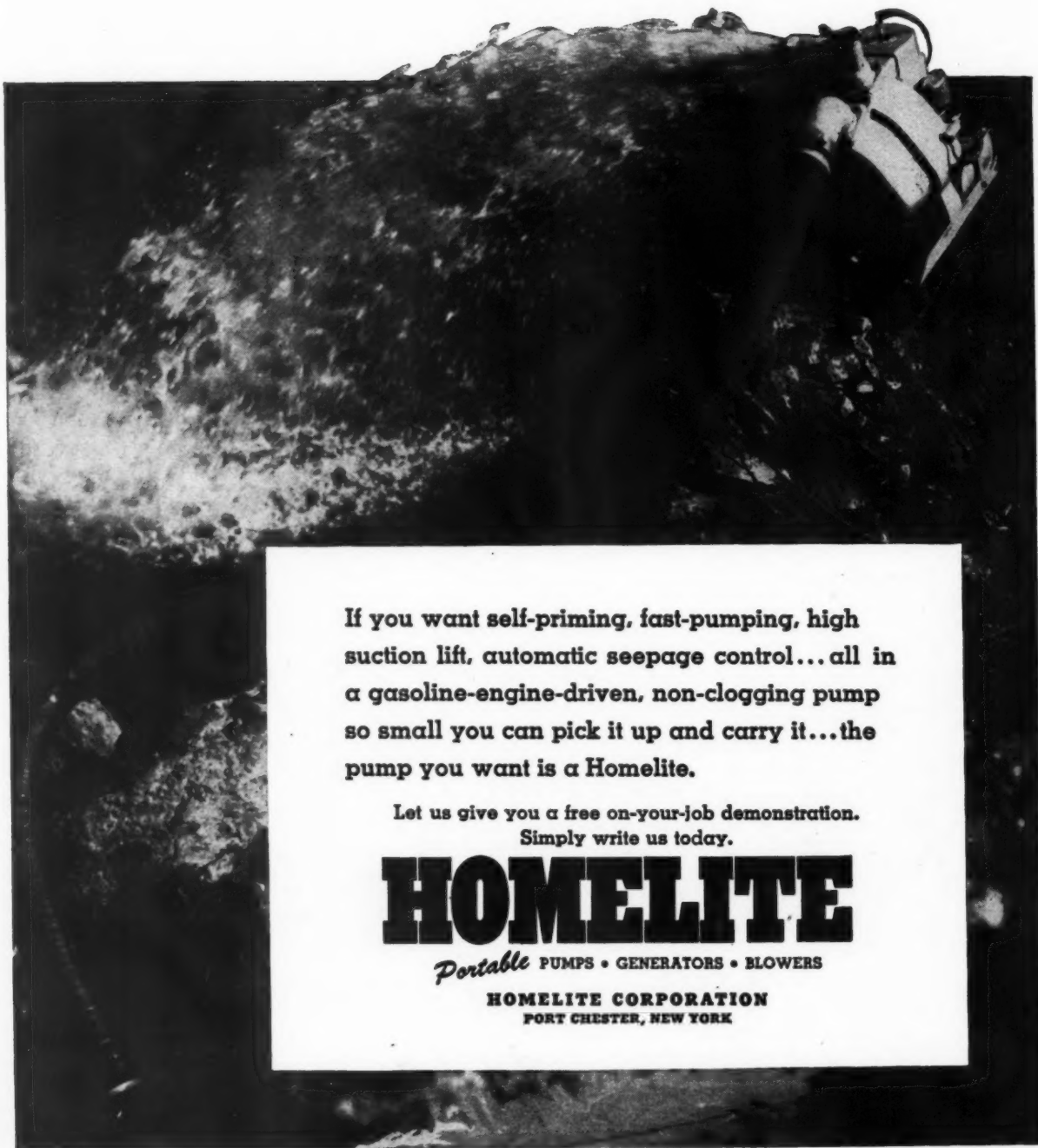
Railway Engineering and Maintenance

January, 1947

9

# The Pump

## TO PUT ON THE JOB



If you want self-priming, fast-pumping, high suction lift, automatic seepage control...all in a gasoline-engine-driven, non-clogging pump so small you can pick it up and carry it...the pump you want is a Homelite.

Let us give you a free on-your-job demonstration.  
Simply write us today.

# HOMELITE

*Portable* PUMPS • GENERATORS • BLOWERS

HOMELITE CORPORATION  
PORT CHESTER, NEW YORK

# SEE FAIRBANKS-MORSE FIRST <sup>FOR</sup> MOTOR CARS

**P**ROVED dependability, safety, and efficiency are important reasons why American railroads have used Fairbanks-Morse Motor Cars profitably for more than 50 years...important reasons why you, too, can use them to good advantage.

Most models are powered by a sturdy, two-cycle, reversible engine which has extra power for curves and grades. The lightweight is a feature especially desirable in this day of high-speed passenger and freight schedules.

There are Fairbanks-Morse Motor Cars for signal maintainers, track inspectors, superintendents, and section or bridge gangs, all made under one guarantee by one manufacturer.

Write today for full details on these economical, smooth-performing cars. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

The powerful Fairbanks-Morse No. 53 car is light enough for one man to handle, yet carries a full section or bridge gang with tools. Hauls loaded trailers with ease.



## Fairbanks-Morse

*A name worth remembering*



Diesel Locomotives • Diesel Engines  
Scales • Motors • Pumps • Generators  
Magnetos • Stokers • Railroad Motor  
Cars and Standpipes • Farm Equipment



### FOR TOP QUALITY BARS AND PLATES IN PRODUCTION-RUN QUANTITIES

Think of it! Here's the steel you need *now*—priced far below mill prices. Warehouses must be cleared quickly for other surplus. Hence this amazing bargain today.

At this price you can afford to stockpile even against next year's requirements—for these savings will pay storage and interest charges over a long, long time.

Order today from any War Assets Regional Office. But for quickest delivery and less risk of disappointment, order from these offices which have the stock on hand:

#### types available:

302, 303, 304, 347, 416, 420, 431, 440. Rounds, hexagons, octagons, flats, squares.

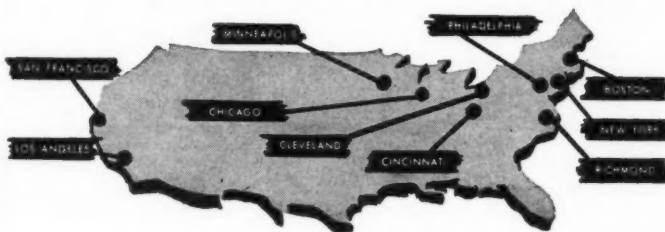
Also fair quantities of stainless steel tubing at about 50% discount from net mill prices f.o.b. location.

★ ★ ★

Orders not accepted for less than 5000 lbs., except where the inventory of any individual item is less. The material offered is subject to withdrawal prior to shipment.

**RESERVE FOR PRIORITY CLAIMANTS**—This material is offered for sale in the following sequence as provided by law: (1) Certified Veterans of World War II; (2) Subsequent priority claimants in proper sequence; (3) Non-priority purchasers. Federal agencies have had opportunity to fulfill their needs. Veterans of World War II should apply to their nearest War Assets Administration certifying office for certification. The case number shown on the certification, the date of the certificate, and the location of the certifying office must be stated in a veteran's offer to purchase.

Stainless Steel is available for export. Any question on export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.



## WAR ASSETS ADMINISTRATION

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Douglas, Utah • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock

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# WHY THIS PERFORATED ARMCO PIPE ASSURES POSITIVE ROADBED DRAINAGE

20' Lengths

Tight Couplings

Drainage Efficiency

## Ample Strength

This is a simple way of illustrating the great strength of corrugated metal pipe. In the case of rigid pipe, the load is concentrated at the top and bottom, while corrugated pipe distributes the load uniformly around its circumference.



These are four important reasons why ARMCO Perforated Pipe gives quick, positive drainage where ballast pockets prove troublesome.

Long lengths mean there is less chance for your subdrainage systems to get out of order because of localized soil-shifts. Strong, tight, bolted joints hold the 20' sections *securely together*. Individual sections of pipe don't get out of line.

ARMCO Pipe is corrugated for high inherent strength. It also has the ability to deflect slightly under loads. This compresses the soil at the sides and tends to equalize the pressure around the entire pipe, thereby increasing its load-carrying capacity. The small, evenly spaced perforations in ARMCO Pipe admit the water freely but exclude the surrounding backfill.

Stabilized with ARMCO Perforated Pipe, your roadbeds need less maintenance. Costs go down. Speed restrictions are lifted. Ballast pockets are completely drained.

For complete information about ARMCO Perforated Pipe, write your nearest Armco Drainage & Metal Products, Inc. office—or the general offices of the company, 3525 Curtis Street, Middletown, Ohio.



## Armco Drainage & Metal Products, Inc.

# Morden Security Split Switch

Assures Safe Operation at High Speeds Under Heavy Loads

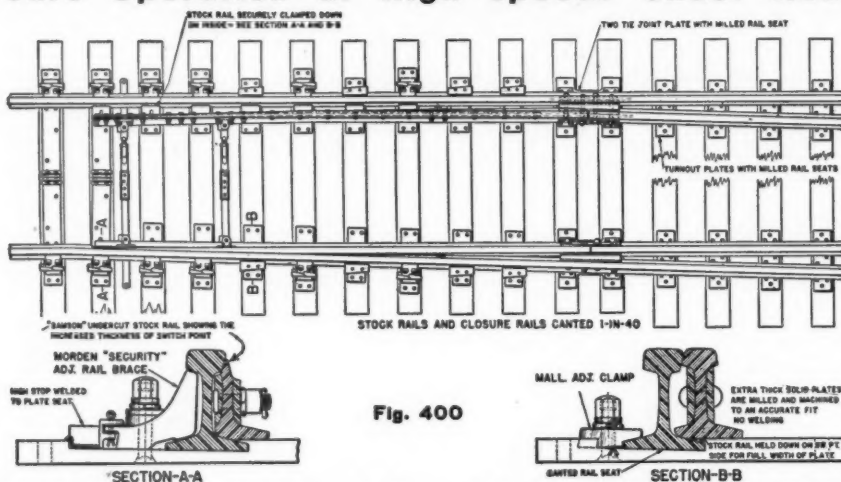
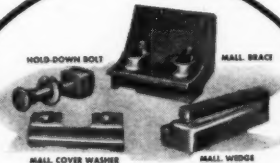
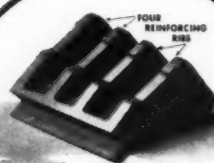
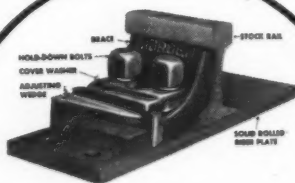


Fig. 400

Designed and built to conform to either A. R. E. A. or customer's specifications, the complete assembly of the Morden Security Split Switch combines the Samson Heavy Duty Switch Point and the Betts switch plate. These details are designed to assure safe operation and promote substantial reductions in maintenance costs.

As additional protection against the shocks of heavy traffic, the switch is braced with a Morden Security Adjustable Rail Brace especially designed for use on split switches.

The services of Morden engineers are available at all times to help you in your maintenance problems.



For Safety's Sake Under Today's Exacting Traffic

## Morden Security Adjustable Rail Brace

The improved Morden Security Brace is specially designed to meet the needs of wartime traffic by providing adequate support for rails subjected to the thrust of heavy wheel loads. The Brace is adapted particularly for use in split switches and slip switches in interlocked territory where it is essential to hold stock rails to proper gage and alinement.

Simple in design, the Brace can be quickly installed, adjusted or removed, without disturbing either rail, tie or plate. Rigorous loading tests have shown that the Security Brace will support a weight of 50,000 lb. at a 45 deg. angle, with a spread of only  $\frac{1}{8}$  in., and a spread of only one inch when this weight is raised to 200,000 lb.

For more than 60 years Morden has pioneered in the construction of frogs, switches, crossings, guard rails, gage rods, rail braces and security track work. Let our engineers help you solve your track maintenance problems.

# Morden Frog and Crossing Works CHICAGO, ILL.

Representatives in: CLEVELAND, OHIO; NEW ORLEANS, LA.; LOUISVILLE, KY.; ST. LOUIS, MO.; WASHINGTON, D. C.

# Big Savings

ONE RAILROAD REPORTS cutting earth-moving cost to as low as three to five cents a yard by using off-track equipment for right-of-way construction and maintenance. Compare this with a former cost of 40 cents to \$1 a yard.

What this railroad has done you can do, too. Modern Allis-Chalmers Diesel tractors will bring big savings to your road on every grading job. Powering scrapers, bulldozers, front-mounted shovels and other auxiliary equipment, these fast, versatile tractors quickly, safely handle any assignment, any place — operate without interference to or from traffic. They put in as much as 50% more working time than rail-bound equipment! You can use them the year-round, too — move ice and snow in winter.

Let us put you in touch with your local Allis-Chalmers dealer for complete facts. Write.



You save on both original investment and operating cost with these Allis-Chalmers Diesel tractors . . . besides getting a better job done . . . and without interrupting traffic.

## ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

### OFF-TRACK EQUIPMENT FOR EVERY NEED

★ 2-CYCLE DIESEL TRACK-TYPE TRACTORS ★ GASOLINE WHEEL TRACTORS  
★ POWER UNITS ★ MOWERS ★ Plus ALLIED ROAD MACHINERY —

Straight or Angle-type Bulldozers, 2- or 4-wheel Scrapers, Tractor Cranes, Rippers, Tractor Shovels, Snow Plows, Sheepfoot Rollers, other units to meet your requirements.

# Main-Line Main • •tenance

is Easier  
With

**LINK-BELT  
SPEEDER**

Simplify and Speed-up your earth-moving or material handling operations by giving such work to a Link-Belt Speeder shovel-crane —Crawler-mounted off-the-track equipment is the logical choice for this type of work, as it is easily maneuvered into its most favorable operating position, and continues to work regardless of traffic on the rails.

Railway men appreciate the clean cut design of Link-Belt Speeder machines, which are engineered for long life, trouble-free operation, high productivity and minimum upkeep. Quick convertibility from one front end attachment to another gives high utility to this rugged machine, which is a shovel on one job, a dragline, clamshell or pile-driver on another job, or a trench-hoe on a still different job.

The Link-Belt Speeder does MORE WORK, MORE KINDS of work, MORE OF THE TIME!



Link-Belt Speeder Model LS-50 equipped as a drag-line, excavating ditches and loading gondolas on the right-of-way improvement program of a prominent western line.

Ask for illustrated bulletin on  
the "CARGOCRANE"  
the Wheel-mounted Yard Crane.

## LINK-BELT SPEEDER

*Builders of the Most Complete Line of*  
**SHOVELS-CRANES-DAGLINES**  
LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO 9, ILL.  
A DIVISION OF LINK-BELT COMPANY

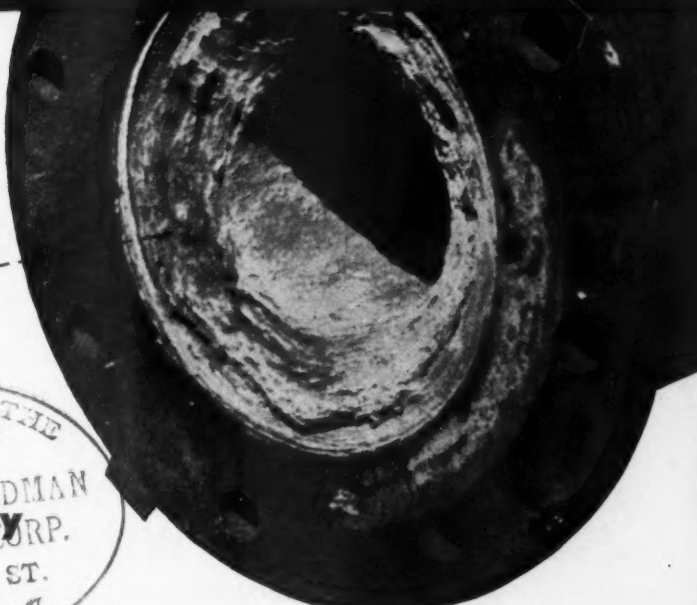
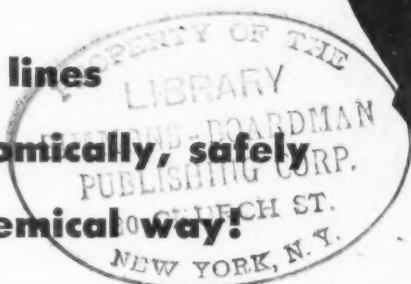
10,540

# DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Do your water lines look like this?

**Clean water lines  
quickly, economically, safely  
the chemical way!**



When efficient operation of water lines is the goal—when a full, free flow of water means something in dollars and cents, Dowell's *chemical* cleaning service merits careful consideration.

The modern, tested Dowell method for quickly and safely removing accumulated scale and sludge has proved effective in water lines everywhere—underground—above ground—indoors or out. Dismantling is unnecessary—even small lines complicated by bends, elbows and valves have been restored to designed capacity. The lines are filled through the regular connections with specially selected liquid solvents designed to dissolve and disintegrate the scale and sludge.

Leading railroads, utilities and other industries rely upon

Dowell's industrial engineers are thoroughly experienced in successful chemical cleaning. They are supported by the full research and technical resources of Dowell's own laboratories.

Dowell's field equipment includes the most modern types of scientific devices. Solvents for Dowell chemical scale removal service are mixed especially to fit each individual job.

Dowell service engineers to perform the entire cleaning operation—bringing with them adequate equipment—special truck-mounted tanks, pumps, mixers, heaters—to control every stage of the successful job. Ask for free booklet—"More Power to America's Industry!" Illustrated in color, it shows how Dowell specialists chemically clean water lines, steam generating equipment, heat-exchangers and many other types of equipment.

**DOWELL INCORPORATED • TULSA 3, OKLAHOMA**

New York, Philadelphia, Boston, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Michigan; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La.  
Long Beach, Casper: Dowell Associate—International Cementers, Inc.



**FREE SHOWING!** New 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. To arrange a special showing call or write Dowell.

**DOWELL**

FOR INDUSTRIAL CHEMICAL SERVICE

# ***TOURNAPULLS*** **work down**



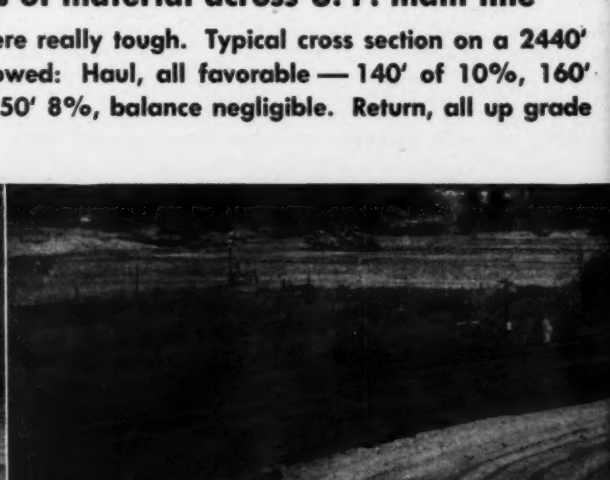
## ***Gibbons & Reed Construction Co.*** **MOVED 100% OF 170,000-YD. UTAH** **JOB WITH THEIR TOURNAPULL FLEET**

Construction of new bridge and highway overpass above Union Pacific tracks at Ogden, Utah, for Utah State Road Commission, meant moving 170,000 yards of sand with mixture of clay. To move dirt fast and at overall lowest net cost, Gibbons & Reed Construction Co., Salt Lake City, handled 100% of the yardage with their high-speed, rubber-tired Tournapull fleet.

**Work down grades to 50% . . . return up to 16%  
. . . haul 75% of material across U. P. main line**

Grades on the job were really tough. Typical cross section on a 2440' round trip showed: Haul, all favorable — 140' of 10%, 160' 40-to-50%, 150' 8%, balance negligible. Return, all up grade

Haul roads were gravelled and well maintained to get most out of Tournapull's high-speed haul.



**LETOURNEAU**  
PEORIA, ILLINOIS



**TOURNAPULLS**

# ON U.P. OVERPASS 40 to 50% grades



— 210' of 11%, 230' 16%, 160' 11% and 400' 6%. In addition, 75% of material had to be hauled across U.P. main line which meant time lost waiting for trains to clear.

## 3 Tournapulls deliver 264 yards per hour on 2440' cycle

Time study, backed by contractor's records, showed that despite adverse job conditions, each Tournapull averaged complete cycle every 7 minutes on the 2440' round trip . . . 3 rigs delivered 264 yards an hour. These Tournapulls drove in from Las Vegas, Nevada . . . made the 550-mile trip in 2½ days.

Investigate the economies Tournapulls offer you on off-track and cross-track dirt movement for your grading, relocation and maintenance work. Your LeTourneau Railroad Distributor has job-proved facts and figures on Tournapulls' ability to deliver lowest-net-cost-per-yard. It will pay you to call him.

Tournapull — Trade Mark Reg. U. S. Pat. Off. 2814

Big tires gave flotation in loose, dry sandy material.

(Below) Return haul was up 6 to 16% grades.

(Below left) Haul each way crossed Union Pacific main line tracks.



## FOR LOWEST NET COST PER YARD



# GOOD DRIVING

*... the Monotube Way!*

JOB-WISE engineers and contractors recognize the importance of speedy, efficient pile driving on every construction job. That's why so many of them depend on tapered, steel Monotube foundation piles for their construction jobs—large or small.

Check these exclusive time-saving and money-saving features:

1. Monotubes drive faster with average job equipment because of their fluted, tapered construction.
2. Monotubes extend to any required length—right on the job!
3. Monotubes' light weight makes them easy to handle.
4. Monotubes are easy to inspect. Their tubular design permits thorough checking before concreting.

Depend on Monotubes—first for foundations. Available in gauge, size and taper to meet varying soil conditions. For complete information write The Union Metal Mfg. Co., Canton 5, Ohio.

## UNION METAL

*Monotube Foundation Piles*

# Machines help solve TODAY'S MAINTENANCE PROBLEMS

Between the mounting demands of today's faster traffic and the shrinking dollar values of working budgets, maintenance problems find increasingly profitable answers in machinery. Where work must be expedited, costs curbed, output stepped up, quality improved, modern maintenance machines provide solution.

The Burlington, powering its popular Zephyr fleet and other fast passenger trains with the newest in diesel equipment, is one of America's progressive railroads using machines to help keep its roadbed in top condition.

Tie-replacement work on the Burlington is facilitated by the use of WOOLERY TIE CUTTERS. These time- and labor-saving machines add efficiency and standardized quality to the routine job of replacing old ties. Cutting ties into three easily-removed pieces, the tie cutters average 50 cuts per hour, including all delays, leaving both rail and tie-bed practically undisturbed, ready to receive the new tie, without disruption of traffic.

## WOOLERY MAINTENANCE MACHINES

are in use today on more than 75 railroads

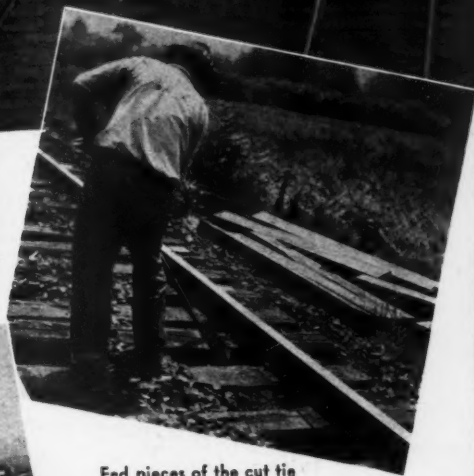
**TIE CUTTERS — WEED BURNERS  
CREOSOTE SPRAYERS**

5-burner, 3-burner, 2-burner and 1-burner models

Write for complete  
information and  
performance data on  
**WOOLERY TIE  
CUTTERS.**



**Burlington  
Route**



End pieces of the cut tie  
are easily pried out with  
a bar, and center pieces  
lifted from between rails.

Tie cutters work most  
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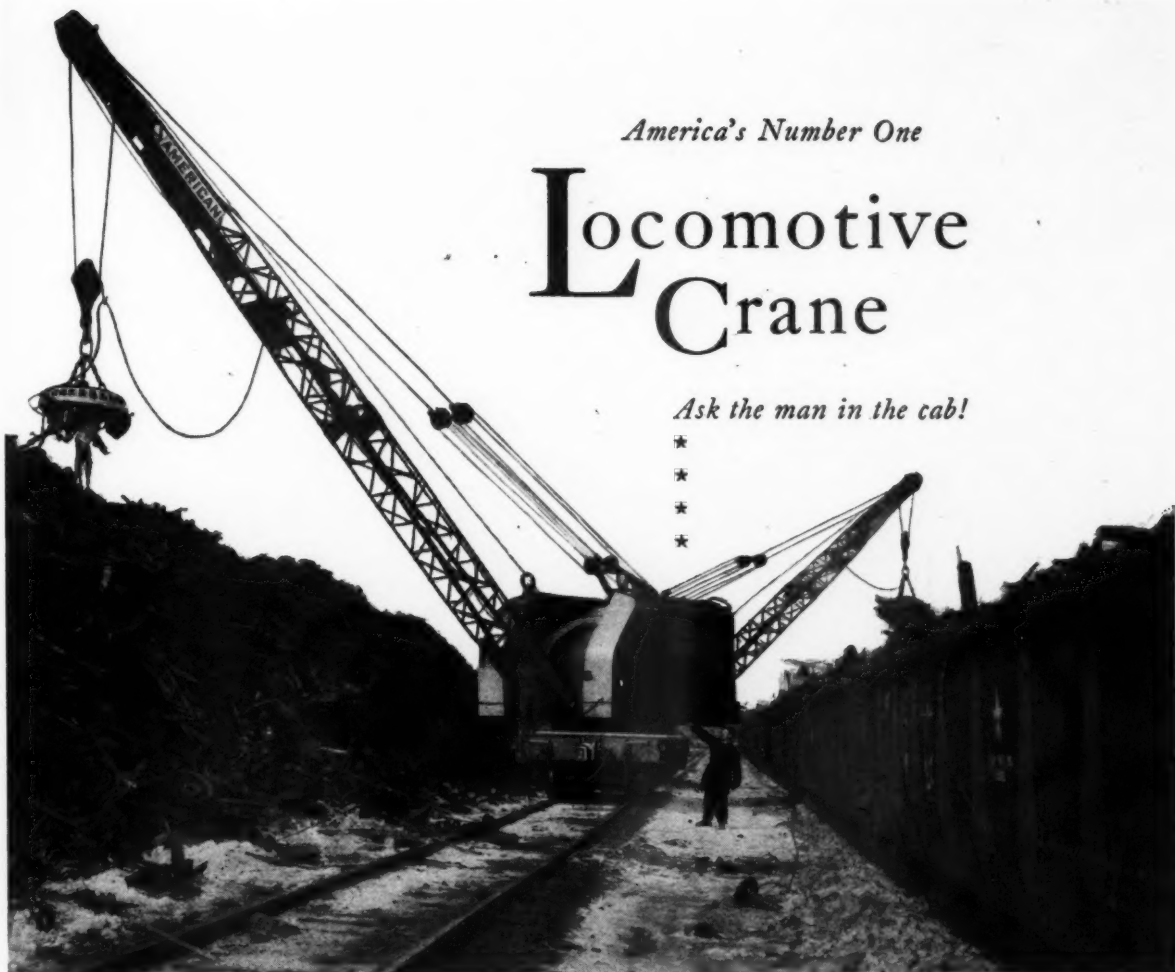
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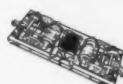
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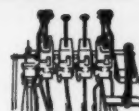
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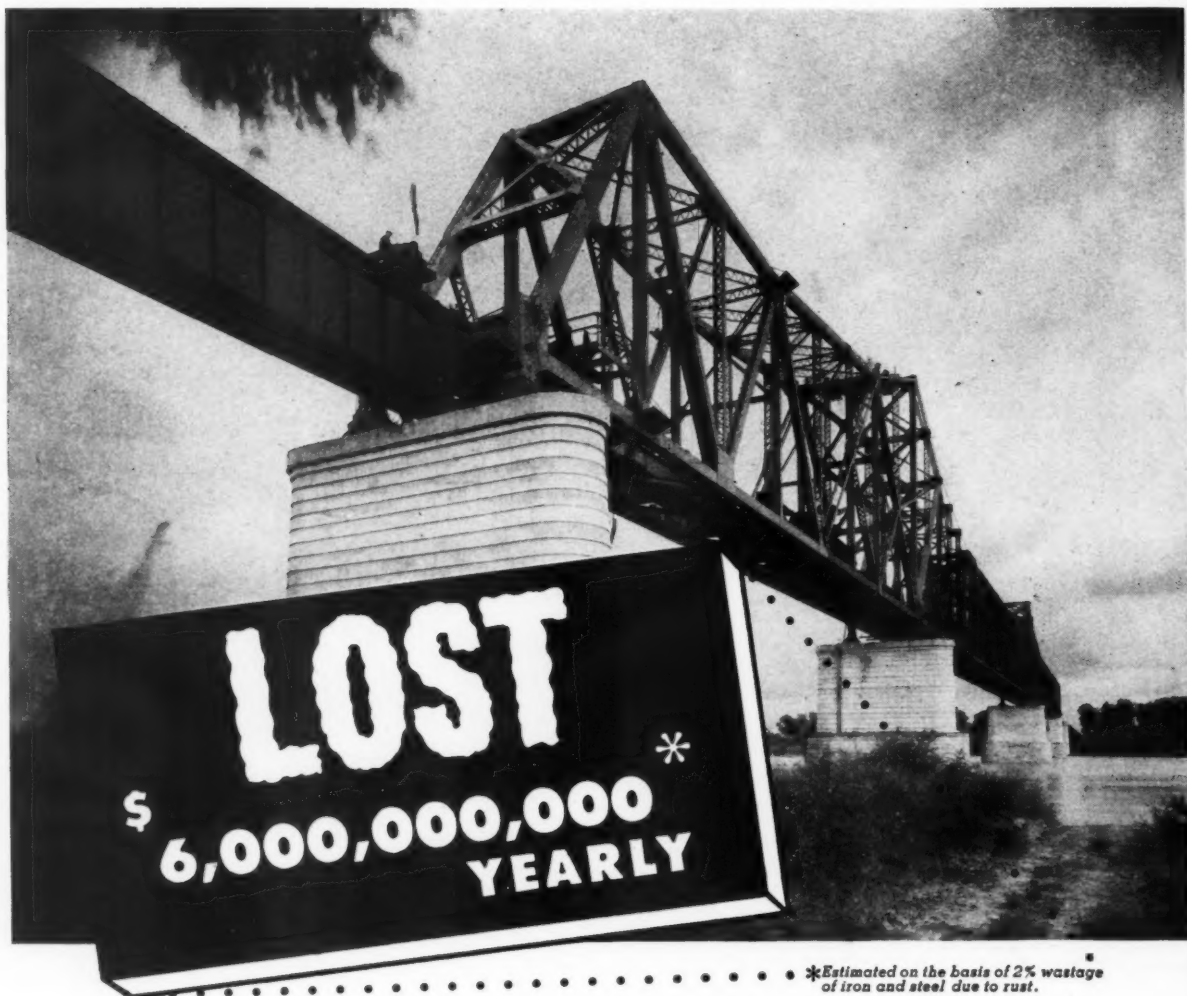
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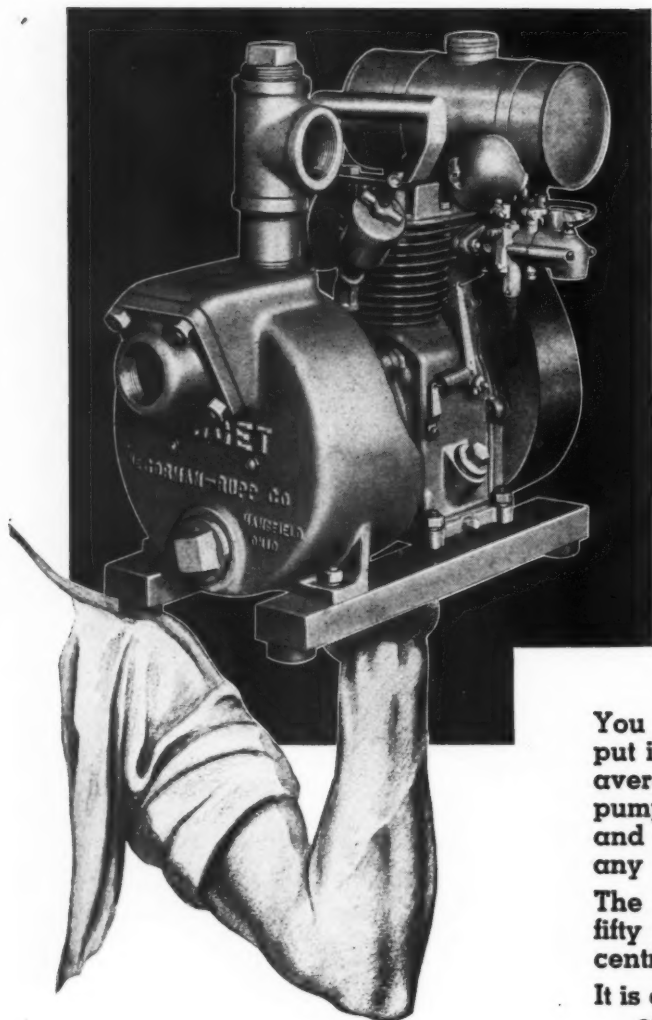
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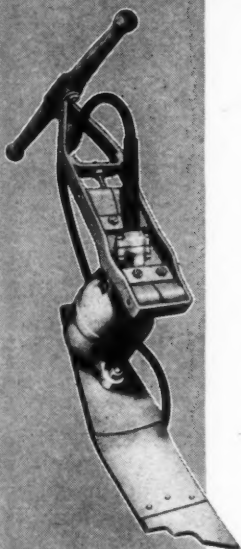
Total Head	Midget (60 lbs.)	Eagle (120 lbs.)	40-M (1080 lbs.)	90-M (1800 lbs.)
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30	3840	10200	34500	76800
40	3720	8400	33900	73800
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IT'S BACKED BY A FIELD ORGANIZATION  
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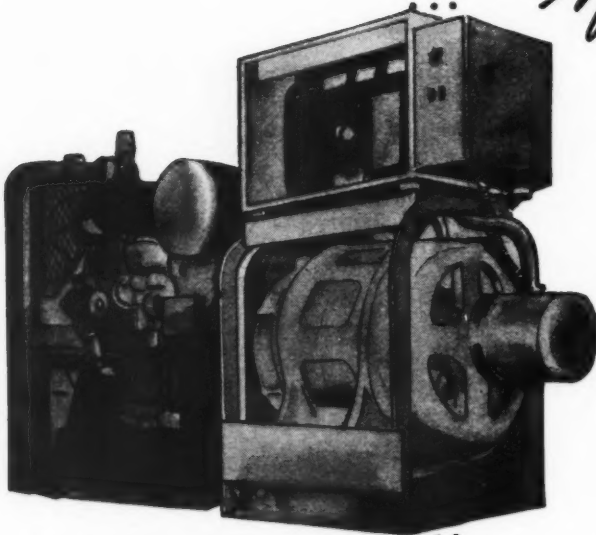
Electric Tamper & Equipment Co., Ludington, Mich.

Right: JACKSON M-2 Power  
Plant—one of several models  
equipped with the new permanent  
magnet generators — no commu-  
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5 KVA (Continuous duty) Single  
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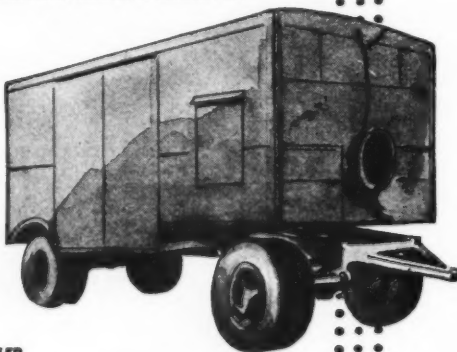
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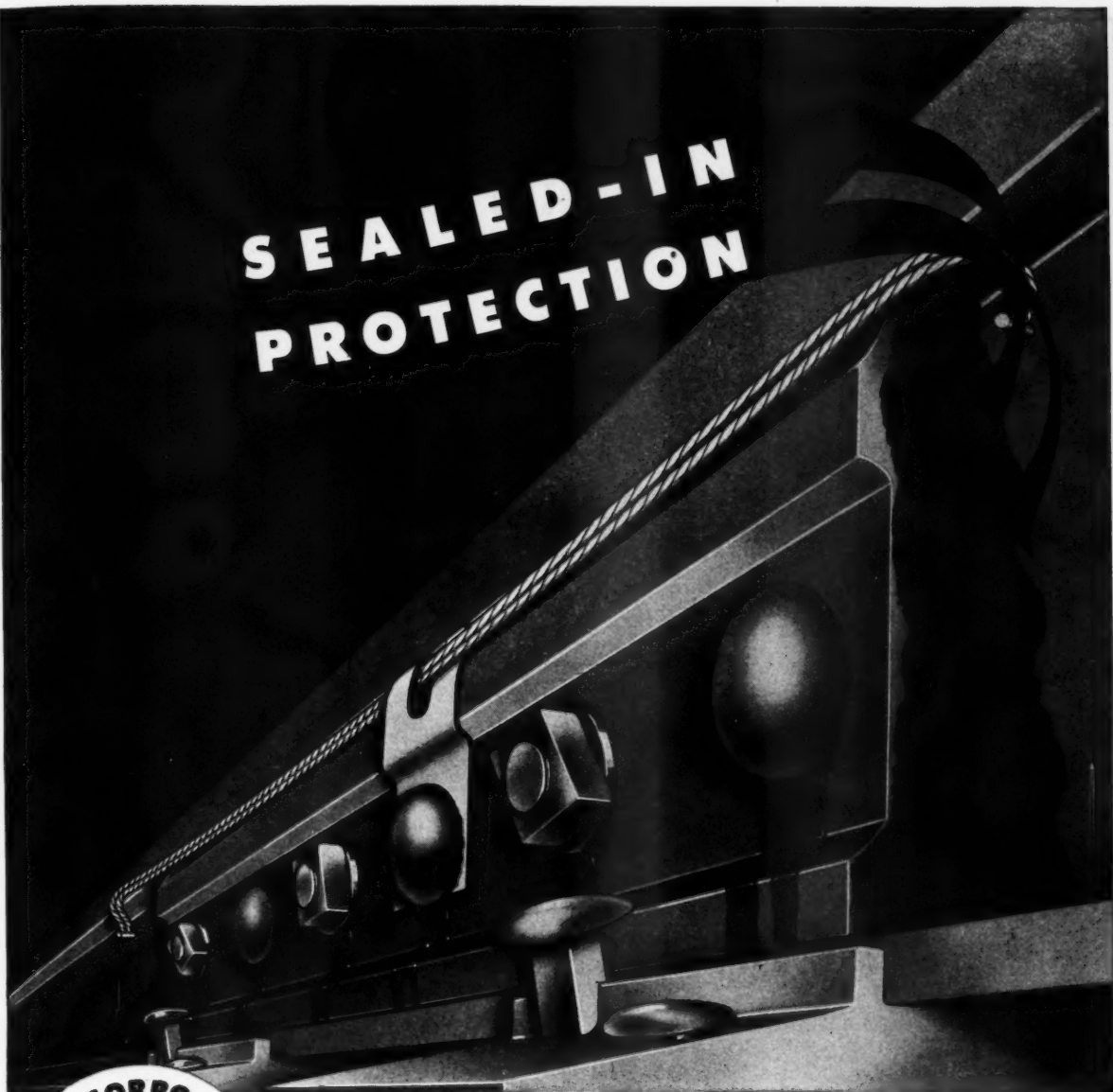
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By **Walter F. Rensch**

*Formerly Supervisor on the Pennsylvania Railroad;  
Author of *Simplified Curve and Switch Work**



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# **Announcing The New CRIBEX**

## **Another Nordberg Development For Track Maintenance**



Here the two Nordberg Cribex are working in tandem, each excavating the ballast from the center of the track outward

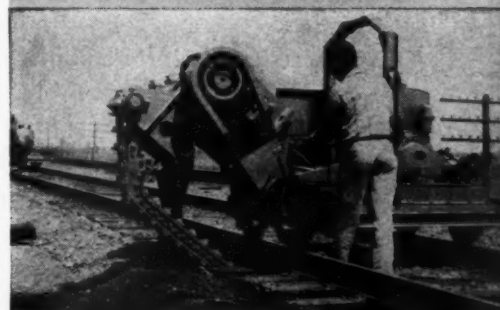
Again Nordberg has pioneered in the field of track maintenance with the development of the Cribex, a machine which excavates the ballast and dirt from the cribs and deposits it beyond the ends of the ties. The Cribex removes mud and dirty ballast which adheres to the ties and leaves a smooth uniformly graded floor slightly below the tie bottoms.

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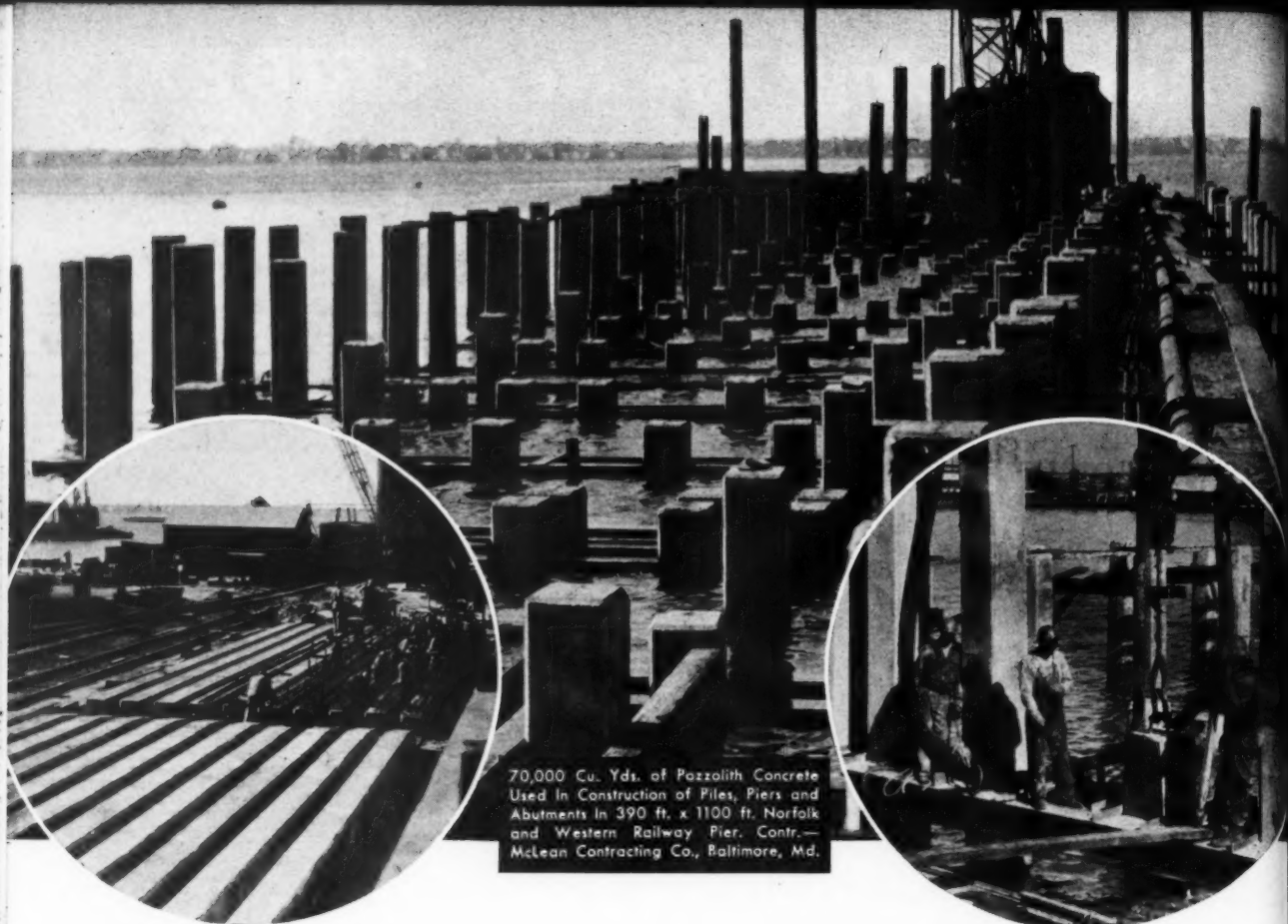


**Digger boom entering crib**



**Crib excavated to center of track**

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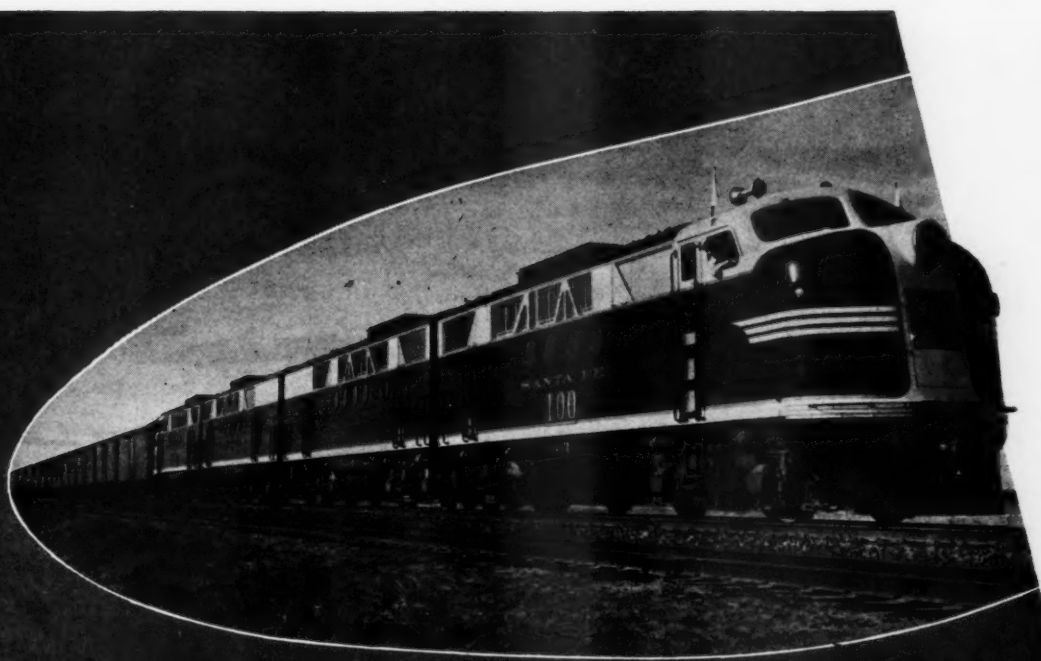
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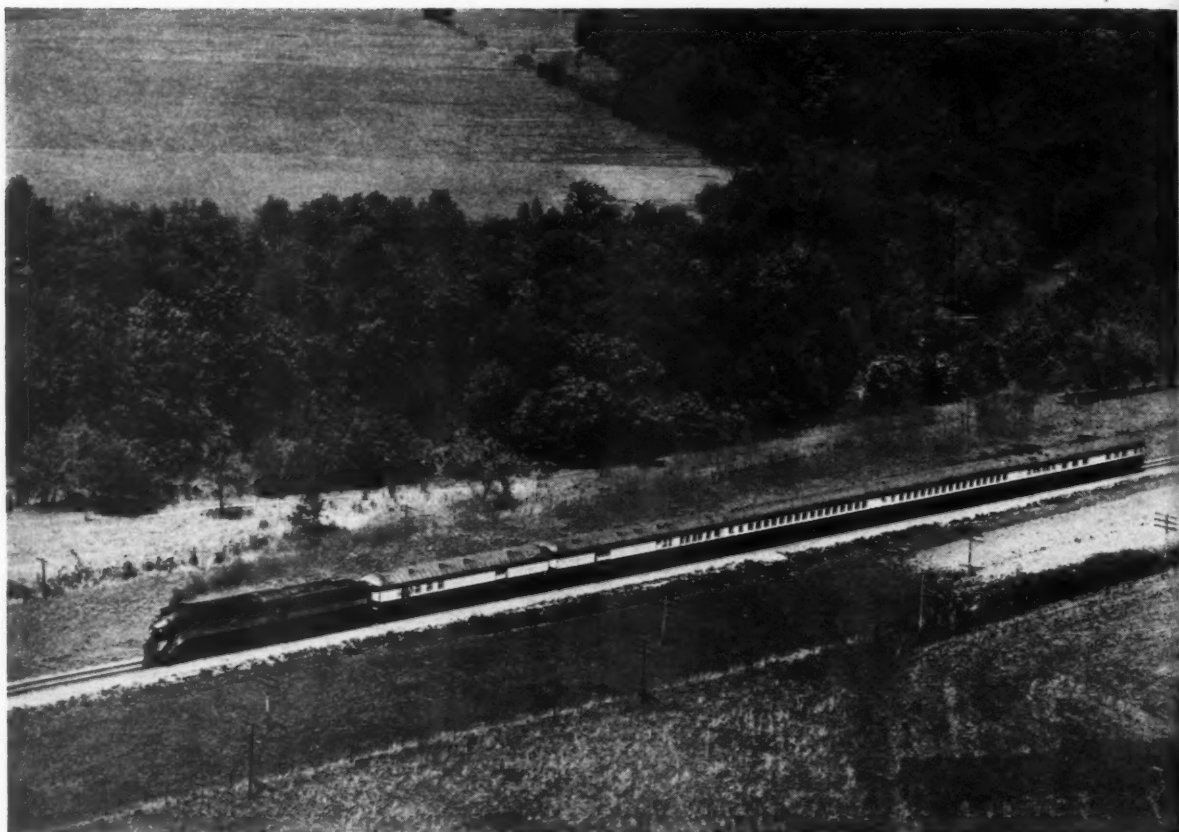
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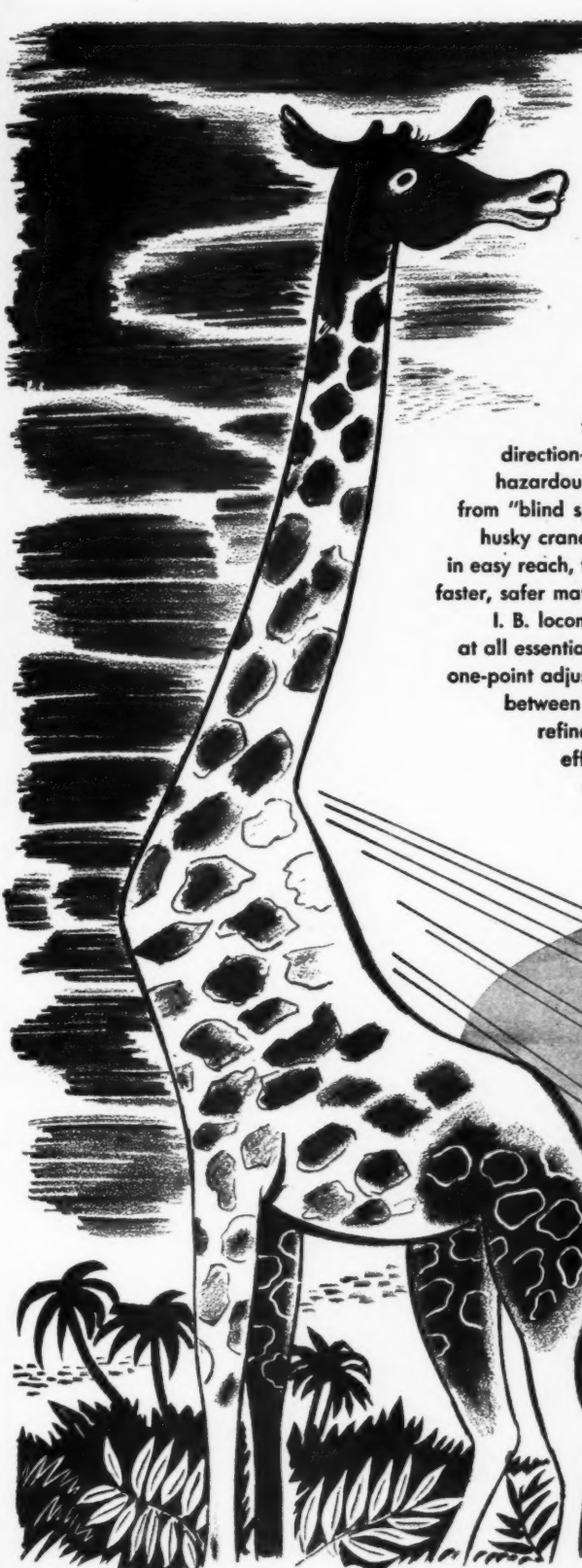
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No. 217 of a Series

## Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.  
CHICAGO, ILL.

Subject: Our New Year's Wish

January 1, 1947

Dear Readers:

I'm sure that you, as I do, look back over the year that has just passed with considerable disappointment. In so many respects, 1946 was far from what we had a right to expect when it was ushered in.

I know that you, as I did, hoped the New Year would be one of peace in its fullest sense, with rapid readjustments abroad and a return to healthy industrial and economic conditions here at home. And it well may have been that kind of a year, but to a large extent, as we so well know, this was not to be.

Wrangling between nations, even between the victors of the recent war, and near chaos in many foreign countries, along with industrial strikes, greatly increased costs, and shortages in nearly everything you have wanted here at home, affected adversely every one of you, directly or indirectly. As a result, fortunate as we have been by comparison with many others throughout the world, the last 12 months are not a too pleasant memory, and the less dwelt upon the better.

As this issue comes to you, we are all starting another year, and while none of us knows what is in store, the horizon appears brighter than for many a day. However, there is one ominous cloud—the possible continuation of labor-management disputes, with their demoralizing effect upon the entire economic life of the country. Let us all hope that these will not materialize on any disrupting scale—that both labor and management will adopt an attitude of understanding, conciliation and fairness, with the greatest good for all the goal.

If this is done, and serious strikes are avoided, 1947 promises to be one of the most prosperous peace-time years in the history of our country. In this the railways will share—will share handsomely if they forge ahead aggressively with their post-war programs of improvements in property and service. Likewise, the companies that supply the railways with their many needs in materials, supplies and equipment, will share. In turn, you, our readers, whether railway men or railway supply men, will benefit correspondingly.

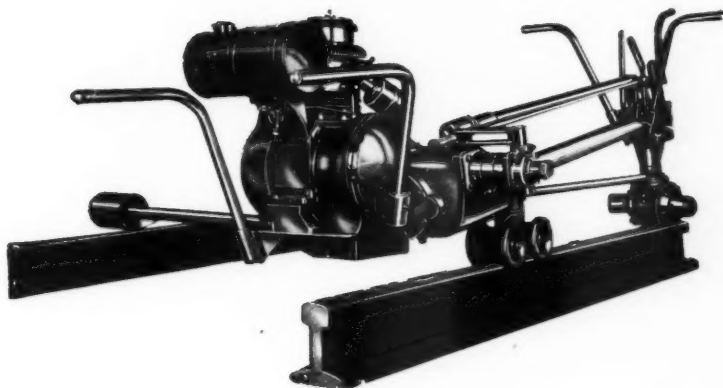
Peace, prosperity, plenty and happiness for all of us are in sight again as we start another new year. That all of these may come to you, and to your loved ones, in abundance, is the fervent wish of each of us on the staff of Railway Engineering and Maintenance.

Sincerely,

*Neal D. Howard*  
Editor

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### **Model B Racor Power Track Wrench**

combines automatic torque control for accurate out of face tightening, with excess power for rapid removal of rusted nuts in rail laying.

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# Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

January, 1947

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# Railway Engineering and Maintenance

## 1946 in Review —

### A Big Year, But a Disappointing One

By many standards of measurement, 1946 was a big year for the railroads, especially for a peace-time year. They served well, and stood ready to render still more and better service; they carried out many improvements in their equipment and fixed properties, and were prepared to do more; and they made huge purchases and commitments, and would have made more under more favorable conditions. But in all these things they were deterred to some extent by conditions beyond their control, to the point where, by many equally important standards of measurement, 1946 was somewhat disappointing.

What took place during the year, which may well be reviewed with profit, is summarized in the following comments and statistics taken from a comprehensive review of railway operations in 1946, prepared by Dr. Julius H. Parmelee, Director of the Bureau of Railway Economics of the Association of American Railroads, with supplemental staff-compiled data relative to construction and maintenance activities.

The railroad industry in 1946 felt the usual disturbing effects of transition between war and peace—lower levels of industrial output, a short supply of goods in relation to demand, rising prices, and widespread labor unrest. On the railroads themselves, locomotive engineers and trainmen walked off their jobs on May 23; for two days, railroad operations were at a virtual standstill. Even more crippling were the two coal strikes of the year, because of their greater length.

#### Traffic Still High, But Net Earnings Low

Total loadings of revenue freight during the year are estimated at 41,250,000 cars, a decrease of 651,000, or 1.6 per cent, under 1945. Carload traffic declined 3.9 per cent, while l.c.l. shipments showed an increase of 14.2 per cent.

Because of decline in the average length of haul per ton from the abnormal war-time high, and in the average load per car, ton-miles of freight in 1946 showed a greater relative decline than car loadings. The aggregate for the year has been estimated by the carriers at 583 billion. This total is 14.4 per cent below 1945 and 20.9 per cent below 1944. It is, however, 30.3 per cent greater than that of 1929, and 74.8 per cent above 1939.

The peak of the return movement of troops from overseas was reached in December, 1945, and January, 1946, and rail movement of service personnel declined rapidly thereafter. Passenger-miles for the year approximated 65 billion, a decline of 29.1 per cent from 1945, and 32 per cent below 1944. The 1946 volume was, however, the greatest for any peace-time year, exceeding the pre-war high of 1920 by 38.7 per cent, and being nearly three times the 1939 volume.

Notwithstanding this greatest volume of peace-time traffic in history, railroad net earnings were little better than those of the depression years that preceded the war. Sharply increased wage rates and prices of fuel, materials and supplies narrowed the margin between revenues and expenses to the lowest relative point since 1920.

Railroad wage increases of 16 cents an hour were awarded early in April, retroactive to January 1. This increase of about 17 per cent (later raised to nearly 20 per cent), together with two previous wage increases during the war (in 1941 and 1943), and substantial price increases since 1940, foreshadowed an increase in operating costs of nearly \$2 billion in 1946.

Faced with this serious situation, the railroads, on April 15, petitioned the Interstate Commerce Commission for authority to increase freight rates

by between 19 and 20 per cent, on the average. The revenue to be derived from the increase sought was estimated at about \$1 billion a year.

Following brief hearings in May, the commission, on June 20, authorized a small interim increase, effective July 1, 1946, which added about \$170 million, or 6 per cent, to freight revenues in the latter half of the year. After further and more extended hearings, it handed down its final decision on December 5, authorizing increases, including the interim increase of July 1, of approximately 17.6 per cent. On the basis of prospective 1947 operations, this is estimated by the carriers to amount to about \$970 million annually.

Offsetting this increase, and to be faced by the railroads in 1947, are the 2½ cents per hour wage increase made toward the end of last May, on top of the 16 cents previously awarded; the effect of the Crosser Act, enacted in July, which increased the rate of payroll tax paid by the railroads from 6½ per cent to 8¾ per cent, effective January 1, 1947; the higher prices for fuel, materials and supplies, which have advanced 7½ per cent since April; the expiration of excess profits carry-back tax credits; and a prospective continuing decline in railroad passenger traffic in 1947. The total of all of these foregoing cost increases and reduced earnings in prospect is estimated at \$2,224,000,000. Thus, the problem confronting the railroads is to absorb the difference between this amount and the prospective increase of \$970 million in freight revenues, and at the same time produce an adequate amount of net earnings—admittedly, not a simple problem.

#### Maintenance High, But Off

Measured by the amount of money spent, 1946 was not an insignificant year in maintenance of way and structures activities, because, while the expenditures made were substantially below those for 1945, they again, for the fourth consecutive year, exceeded \$1 billion. Based on official figures for the first nine months of the year, it is estimated that total expenditures of the Class I railroads for maintenance of way and structures work in 1946 amounted to approximately \$1,160,000,000. At its face value, this represents a decrease of \$251,300,000, or about 17.8 per cent, compared with 1945, and a decrease of \$103,000,000, or 8.2 per cent, compared with 1944. However, and not without significance, is the fact that the expenditures made amounted to 2½ times those for 1939 and 1½ times the average annual expenditures for the period 1925-1929, inclusive.

#### Rail and Tie Renewals Down

But before the dollar value of expenditures for 1946 can be used as an index of activities or accomplishments, allowances must be made for a number of factors that have tended increasingly in recent years to create a disparity between total expenditures for maintenance of way and structures and the actual amount of work accomplished. Prominent among these are the higher wage scales and the greatly increased prices for materials and supplies that have assumed such importance in the present-day economy.

That, in spite of the large expenditures during 1946, substantially less actual work was accomplished than in recent years, is seen by a study of

almost any one of the important classifications of work undertaken by the maintenance forces. For example, one classification to show a substantial reduction was rail renewals. For 1946, these are estimated at 1,218,000 gross tons, on the basis of information furnished by practically all the Class I roads of the country. This figure represents a reduction of 396,000 tons, or nearly 25 per cent, compared with the new rail laid in 1945, and is less than that for any year since 1940. Likewise, it is far below the average of 2,064,710 tons laid yearly from 1925 to 1929, inclusive, but is far above the amount laid annually during the depression years, which reached a low of 394,536 tons in 1932.

Crosstie renewals in 1946 also showed a substantial decline compared with the previous year, amounting to approximately 37 million (again an estimate, based upon figures supplied by practically all of the Class I roads), or about 6,900,000 (15.7 per cent) fewer than the number of insertions in 1945. This decline brought tie renewals last year to the lowest level in many years, and to possibly an all-time low. In fact, the estimated number of renewals in 1946 is even less than the figure for 1933, the low point in the depression, when renewals amounted to 37,295,716 ties.

#### Construction Activity

Despite optimistic predictions at the beginning of 1946 for greatly increased activity in railway construction over that possible during the war years, actual accomplishments here too fell considerably below expectations. As a matter of fact, influenced by the same factors that restricted most classes of maintenance of way and structures work, it is estimated that the amount of improvement work the railways were able to carry out in 1946 was somewhat below the total of such work performed in 1945, when it amounted to a total of approximately \$248,000,000.

Thus, while a record of the major projects carried out by the roads last year shows a surprisingly large amount of improvement work undertaken, and, in fact, covering a wider range of projects than for many years in the past, it also indicates unmistakably that the number and scope of many classes of badly needed construction projects were greatly limited during the year.

#### What's Ahead for 1947

What is the outlook for construction and maintenance in 1947? The answer to this question is so bound up with so many uncertainties, including the situation to prevail in the labor and equipment markets, the general economic health of the country, and the earnings of the railways, that even an intelligent guess is difficult. However, it is certain that the fact that new construction and maintenance programs in 1946 were restricted, plus the increasing need for new and improved facilities, higher standards of maintenance, great productivity, and increased economy, will increase the need for large programs of new construction and maintenance in 1947. Furthermore, the belated but sizeable increase in freight rates allowed the railroads, effective January 1, 1947, is certain to have a favorable effect on the financial standing of the roads, and on their ability to make enlarged expenditures in the year ahead.

Right—Purchases of Grading Equipment in 1946 Were Greater Than for Any Prior Year Except 1945

Below—Liberal Purchases Were Made During the Year of Discers and Scarifiers and Related Types of Equipment



Despite Restricted Railway Earnings, Delayed Deliveries from Manufacturers and Other Unfavorable Factors, 160 Roads Purchased 9,939 Power Machines and Power Tools in 1946. Present Indications Point to Further Mechanization at a High Level for Work in 1947

## Railways Spent **\$15,400,000** for Work Equipment in 1946

THE use of power machines and tools continued at a strong pace in 1946, even though railway work programs and the purchases of such equipment for the year were not as extensive as in 1945. However, this decrease was not contrary to the expectations of most maintenance officers early in the year, who, though recognizing the need for intensive work programs to maintain their tracks and other structures in a manner commensurate with the continuing heavy traffic, nevertheless, did not anticipate that work equipment purchases would reach the all-time high of the \$17,500,000 spent in 1945. Yet, the total number of units of work equipment acquired by the railroads in 1946 is still impressive, being about equal to that in 1944, and greater than in any earlier year.

That the use of power machines and tools became more firmly established on the railroads is borne out by the fact that 160 railways in the United States, Canada, and Mexico reported the purchase of 9,939 units of work equipment in 1946. This compares with the 11,733 units purchased in

1945 and 9,984 units purchased in 1944. Yet, while the number of units purchased last year equaled approximately those of 1944, the expenditures for work equipment in 1946 totaled \$15,400,000, an increase of about \$1 million over 1944, indicating not only the higher unit costs that prevailed in 1946, but also the fact that, in spite of these higher costs and other unfavorable factors that prevailed during the year, maintenance officers attached great importance to filling their needs for a wide variety of power tools and machines.

### Hampering Factors

The figures for work equipment purchases in 1946 were prevented from being even more impressive than they are by several factors, the most important of which were the relatively low net income of the railways

throughout the year, the somewhat restricted size of construction and maintenance programs, the shortages of labor in some localities to carry out major operations, and, in many cases, the inability of equipment builders to make prompt deliveries.

As to the labor situation, although it was anticipated at the beginning of the year that there would be a continued labor shortage for the first six months of 1946, it was expected that this situation would be considerably alleviated by the return of many former employees released from military services and from war plants. But this situation did not materialize to anywhere near the extent expected because of the reluctance of discharged servicemen to return to their

old jobs and the widespread refusal of released war-plant employees to work at jobs that paid less money than they had become accustomed to receive, with the result that shortages continued in many areas, severely restricting many classes of programmed work.

### Programs Are Curtailed

The wage increases granted employees accomplished little in attracting more men to railroad work, but the increases did raise the cost of doing work to a marked degree. This, coupled with the shortages of labor and materials, and the drastic reduction in railway earnings during the year as the result of strikes, especially the November-December slowdown, and the long-delayed action on the part of the Interstate Commerce Commission in granting the roads their requested increase in freight rates, brought about a curtailment in work programs.

Other factors that led to the curtailment of practically all classes of roadway and structures work were shortages in materials, notably rail and fastenings, ties, lumber, timber and structural steel, all of which tended also to restrict the need for

power machines and tools to progress their work at the same rate.

As indicated previously, another reason why the railroads did not purchase as much work equipment in 1946 as in the previous year was the inability of many builders to make prompt deliveries. This was brought about primarily by labor unrest throughout the year in many basic industries, which resulted in shortages in certain materials, such as steel of various grades, gray and malleable iron castings, lead, copper and lumber, which enter into the construction of such equipment.

### 1947 Requirements

To estimate the requirements for work equipment in 1947, consideration must be given to many factors, including the magnitude and types of work in prospect, the probability of procuring an adequate labor supply to carry out the programs set up, the ability of the railroads to finance these programs, and the dependence that can be placed on equipment builders to produce and make deliveries of the equipment desired.

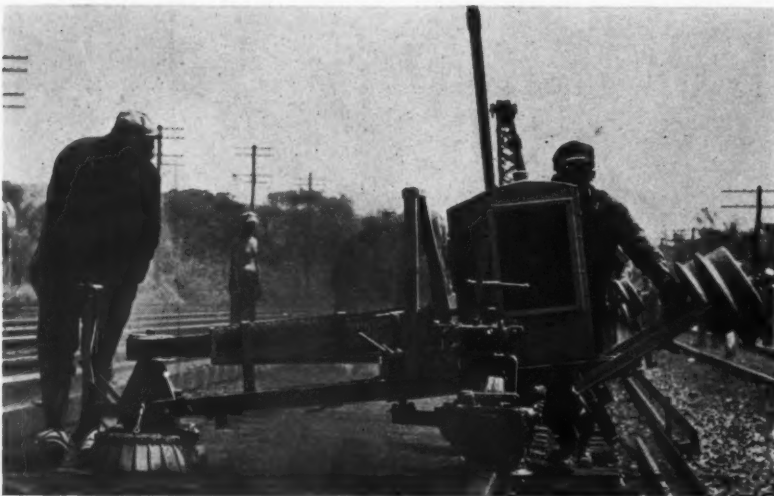
To ascertain the amount and character of work in prospect for 1947, a restricted survey was undertaken

air and highway competition through increased comfort, greater speeds and a still higher degree of safety. To carry out this work economically, including grading, rail renewals, ballasting, surfacing, ballast cleaning, tie renewals, weed control, snow fighting, bridge and building repairs, and a wide variety of miscellaneous operations, thousands of machines and power tools will be required. In all probability the labor supply will continue "tight" in 1947. In any event, at present wage rates, labor will be costly. As a result, the railroads will have to rely more than ever before upon work equipment, not only to increase the efficiency of their forces through increased production, but also to ease their work. Although the builders are constantly improving their equipment and producing new machines and tools, the use of such equipment is long past the experimental stage and is so well established that many men refuse roadway and structures work unless labor-saving equipment is available, particularly for the more arduous tasks.

While maintenance officers would be the first to protest that their properties are not in a condition well on the safe side, nevertheless, it is generally recognized that maintenance programs, incompleting during recent years, largely because of the inability to procure the necessary labor and materials, have not kept pace with the wear and tear wrought by heavy traffic. Hence, it is logical to anticipate that every effort will be made to complete the larger maintenance programs planned for 1947.

Moreover, the belated but sizeable increase in freight rates allowed the railroads beginning January 1, 1947, is certain to increase their net income in the year ahead, and thus their ability to carry out increased maintenance programs, because it is axiomatic that as goes the curve of net earnings, so goes the curve of maintenance expenditures—an adaptation of the old adage, "cutting one's coat according to one's cloth."

As to the ability of the builders to produce the work equipment required, without discouraging delays, the possibilities are not clear, for, while higher prices should give impetus to the production of the necessary basic materials and component equipment parts and accessories, the demands of labor in industry generally have not been fully reconciled. On the other hand, there is such an insistent demand on the part of the public for improved labor-management relations, and industrial peace, that it is entirely possible that, from an industry production standpoint, 1947 will be a



A Total of 1199 Units of Rail-Laying Equipment Was Purchased

additional units of work equipment. Thus, many large-scale programs were hampered both by gangs of inadequate size and shortages in materials, making necessary constant changes in organization to balance the various phases of work operations. This was especially true in the case of gangs engaged in rail laying, surfacing, and ballasting, where the small units making up these gangs are manned and equipped with specialized

among a few of the larger roads and, while most of them have not as yet completed their budgets, indications are that the work programs being planned are approximately equal to those made at this same time last year, before it became necessary to curtail them. This, in itself, is evidence of the vast amount of work that is necessary on the railroads if they are to maintain their properties to the high standards necessary to meet effectively

great deal brighter than the year just past.

From the foregoing, two things are apparent: that there is a vast amount of maintenance work to be done in 1947, with the railroads certain to be in a stronger financial position than in 1946 to carry it out, and that they will need thousands of additional and replacement units of work equipment to do this work, and look to the builders to furnish them.

#### Source of Information

To obtain the detailed information given on following pages concerning work equipment purchases in 1946, questionnaires were sent to all of the railways in the United States, Canada and Mexico with regard to their purchases. Replies were received from 400 roads, the equivalent of 78 per cent of all of the railways in these three countries, and including all but one Class I road in the United States and one large road in Canada. Of this number, 160 roads reported purchases of work equipment amount to 9,939 units. This number of roads is a decrease of 12 under the number that reported purchases in 1945, but a gain of three over the number of roads reporting purchases in 1944. It is apparent that if reports had been received from the two large roads which did not make a report, the total number of units of work equipment purchased would have gone well over 10,000, because it is known that these two roads purchased such equipment liberally in the past.

#### Transportation Units

In reviewing the reports made by the various railroads, it is significant that the number of track motor cars purchased in 1946 exceeded that of 1945, for here is a unit of equipment that, except for a relatively negligible number of heavy-duty cars bought for the transportation of large groups of men, is purchased year after year largely for replacement purposes. With purchases totaling 2,877 cars, this item of equipment led all others in the number of units purchased, as it has done consistently for the last decade. Too, it should not be overlooked that the large number of motor cars purchased in 1946 follows purchases of 2,738 cars in 1945, 3,131 cars in 1944, and the all-time record of 3,239 cars in 1943. In addition, 1,289 push cars and trailers were purchased in 1946, topping the 1,192 units purchased in 1945 and only 85 units below the high number of 1,374 cars purchased in 1944.

From the foregoing it is readily

evident that the transportation of men is of the greatest importance to maintenance of way and structures operations. With motor cars and trailers, the men can be carried with their tools directly to points of work, where they arrive fresh to carry out their duties. The importance of adequate transportation facilities for men is evidenced further by the large number of automobiles and station wagons



Motor-Car, Push-Car and Trailer Purchases Were at a Near-Record Level

purchased in 1946, a total of 136, compared with 60 in 1945 and 65 in 1944.

Paralleling the increase in units for the transportation of men is the increase in the number of vehicles purchased for the transportation of tools, equipment and materials. Aggregating 418 units in 1946, the purchases of highway trucks and trailers reached an all-time record in that year. Undoubtedly, as in the past, the purchases of this type equipment were brought about in large measure by the difficulty of distributing materials and supplies in congested areas, and of getting the working forces to and from points of work in such areas. It is of interest also to note that several large truck-trailers were purchased in 1946 for hauling heavy off-track grading units over the highways. The 418 truck units purchased included 368 trucks with capacity varying from  $\frac{1}{2}$  ton to 3 tons—with the  $\frac{1}{2}$ -ton predominating—and 50 trailer units. This total number compares with an aggregate of 350 trucks and trailers purchased in 1945 and 299 in 1944.

#### Grading Units

Strong interest continued during 1946 in grading units, as the roads purchased a total of 301 such units, indicating interest on their part in such major operation as line changes,

curve and grade reductions, embankment restoration, channel changes, cut widening, tunnel daylighting, and right-of-way grading. Liberal purchases of these units have been made for seven consecutive years and, while the number of units purchased in 1946 is below the record 505 units purchased the previous year, it is known that deliveries could not be secured in 1946 of all of the units that the railroads had on order. However, the number of units purchased last year exceeded the number purchased in any year except 1945.

Included among the 301 units purchased in 1946 were 9 spreaders, 46 draglines and shovels and combinations of such units, 47 bulldozers and angledozers, 2 mobile graders, 4 dump trucks, 131 tractors, and 62 miscellaneous units—all, except for the spreaders, being of the off-track type. Among the miscellaneous units purchased were power rollers, front-end loaders, scrapers of various sizes, dump wagons, and ditching machines.

#### Rail-Laying Equipment

Owing to the difficulty in securing delivery of rail, fastenings and other accessories, rail-laying programs were curtailed during 1946, compared with 1945, but some roads are continuing this type of work through the winter to install rail delivered just recently. Despite the reduction in these programs, substantial purchases were made of rail-laying equipment to lay the 1,218,000 gross tons of new rail that was obtained for laying in primary lines, and a large part of the released rail that was relaid in less important tracks.

For this work 1,199 units of rail-laying equipment were purchased. This was 248 units fewer than the high of 1945, but was more than the number purchased in any preceding year except 1945. Included in this total were power adzers, spike pullers, bolt tighteners, spike drivers, rail drills, rail grinders, power rail cranes, and a small number of cribbing machines of the type used with rail-laying operations. The number of rail cranes purchased was 57, this being the largest number in any single year of record.

#### Ballasting and Surfacing

Ballasting and surfacing programs were curtailed more drastically in 1946 than rail-laying programs, largely because of the difficulty in securing the full complement of men necessary to such programs. At times, many gangs were only half-manned, and it often became necessary to combine

two or more gangs to obtain greater efficiency of the men and equipment. Accordingly, most roads confined their ballasting and surfacing to track relaid with new rail, and deferred such work on track not relaid. Since this condition followed a similar one during the previous year, when a labor shortage also existed, it is obvious that the railways are faced with a huge backlog of surfacing and ballasting work if they are to maintain their tracks to the high standards necessary to meet successfully the competition of other forms of transportation.

Furthermore, the railways cannot permit the large deficiency in this class of work to grow larger or they will see their properties deteriorate to the point where necessary slow orders will seriously impair train schedules. It is here that the roads will have to pursue a more vigorous policy to obtain an adequate supply of labor and, to do so, they must give greater consideration to the things that will attract and hold men. One of these things is to make maintenance of way work more attractive and less arduous

if they will study maintenance gangs in action and devise additional machines and tools to lighten and speed up their work.

Owing to the curtailment of ballasting and surfacing programs in 1946, the number of work equipment units purchased during the year specifically for such programs was only 1086, compared with the 2,307 units purchased in 1945 and 1,073 in 1944. These included power jacks, tie tamping outfits and unit tampers, ballasting machines, cribbers, and large and small units of ballast cleaning equipment. The figure given does not include spreader-ditchers, as these units are grouped with grading equipment.

Purchases of tie-tamping equipment in 1946 totaled 352 complete outfits, compared with the all-time high of 1,320 outfits purchased in 1945 and with 478 purchased in 1944. The four-tool units, both electric and pneumatic, were the most popular, although several 8-tool and a few 16-tool outfits were also purchased. Aside from the complete outfits, 111 separate tamping tools were purchased for

266, respectively purchased in 1945, and 67 compressors and 85 generators purchased in 1944.

It is of interest to note that the number of complete welding outfits purchased in 1946 reached an all-time high of 59. This compares with 38 such outfits purchased in 1945. Since all of these outfits were of the portable type, it is apparent that more repairing is being done in the field than heretofore for such work as building up worn rail ends, frogs, switches, and special trackwork items, and for cutting purposes.

### Weed Destroyers

As to be expected in any year of restricted earnings and shortages in labor, the railroads did not devote as much time to weed eradication in 1946 as there was need for. However, liberal purchases of weed-destroying equipment were made in 1946, aggregating 237 units. This compares with 279 units purchased in 1945 and 333 in 1944, and includes discers and scarifiers, drainage units, chemical spraying outfits, hand and track-type weed burners, extinguisher cars, and both on and off-track mowers.

One hundred and thirty cranes of all types were purchased in 1946, which is the highest total that this type of equipment has reached in any year of record. It compares with 119 cranes purchased in 1945 and 76 in the year previous. This total includes 57 rail cranes, as mentioned previously, but does not include derrick cars, a considerable number of which were also purchased.

### Miscellaneous Units

Many other types of equipment, aggregating 881 units in all, were purchased in 1946, but these cannot be discussed in detail. This total includes concrete mixers, concrete vibrators, paint-spray outfits, portable pumps, rail and flange lubricators, timber saws, grinders other than for use in track work, snow plows and sweepers, tie borers, tie pullers, tie saws, power wrenches, derrick cars, roadbed-grouting outfits and many other types of equipment.

The detailed list of purchases by individual roads is omitted again this year. When the record was started, this detailed list served to emphasize the extensive purchases that were being made by those roads that had been using power machines and tools for the longest time, and at the same time directed attention to the growing list of roads that were purchasing such equipment.



Many Roadbed-Grouting Outfits Were Acquired

by providing ready and convenient transportation for the men to and from work, and by equipping them with the proper tools to carry out their operations with minimum fatigue.

No track maintenance operations exact as much energy or result in as much fatigue as those associated with ballasting. Although many fine machines and tools have been devised for such work, such as cribbing machines, ballasters, power jacks, mobile compressors, tie tampers, track shifters, spreaders, and ballast cleaners, the railroads do not have enough of them, and are not taking full advantage of the opportunities afforded by these machines to induce men to accept this kind of work. Moreover, there is great need for other machines to assist in track maintenance operations, and manufacturers can be of great help

replacements. In addition to the multiple-tool outfits, 537 unit tampers were purchased in 1946, compared with 876, another all-time high, purchased in 1945, and 544 in 1944.

### Power Plants

The tie-tamping outfits purchased, as well as the welding outfits and paint-spraying outfits mentioned later, all include the power plants necessary for their operation. In addition to these power plants, however, the railroads make annual purchases of other such power plants to replace worn-out units of the same type, and also to activate the small portable tools used in bridge and building work. In 1946, purchases of these additional units included 136 air compressors and 243 generators, compared with 201 and

## Six Killed in Two Track-Car Accidents

SIX maintenance of way employees, including a general roadmaster, lost their lives in two recent motor-car accidents in which the cars were involved in head-end collisions with trains. The accident in which the general roadmaster was killed occurred about 2:17 p.m. on August 2, 1946, near Ozone, Tenn., on the Tennessee Central, while the second accident, which cost the lives of five members of a section gang, took place about 9:10 p.m. on September 18, 1946, on the Louisville & Nashville, near Morton, Ky. According to the reports of the Interstate Commerce Commission on these accidents, based upon its investigations, failure of the respective railroads to provide adequate protection for the movements of the track cars was responsible for each of the collisions. The following information is abstracted from the commission's reports.

### On the Tennessee Central

The accident on the Tennessee Central occurred on that part of the road which extends between Nashville, Tenn., and Harriman, a single-track line over which trains are operated by timetable and train orders, and on which no block-signal system is in use. The general roadmaster, a supervisor of bridges and buildings, and an assistant roadmaster were making a motor-car inspection trip westward from Harriman and stopped at Ozone, 143 miles west of Harriman, about 2 p.m., to obtain information relative to train movements.

Instructions governing the operation of track motor cars on this road require that the person in charge of a car must, when practicable, get information from the dispatcher regarding the movement of trains, and that cars be clear of the main track ten minutes before passenger trains are due. In addition, telegraph operators are required to provide motor-car operators with written line-ups which, if received over the telephone, must be put down in writing and repeated to the telegraph operator. Track-car operators are instructed not to accept a line-up until they have repeated it to the telegraph operator and are told that it is properly understood. Further, track-car operators are instructed not to intrust any other person with this responsibility.

Upon stopping at Ozone, the supervisor of bridges and buildings communicated by telephone with the operator at Crab Orchard, four miles west of Ozone. He was advised that No. 1, a westbound passenger train, and No. 2, an eastbound passenger train, would meet at a point known as Dorton, 11 miles west of Ozone. He was also told that No. 60, an eastbound freight train, had not as yet arrived at Crab Orchard and that this train would be delayed at Crab Orchard for about 30 min.

The three men then discussed the line-up at some length and it developed that there was some question as to whether the supervisor of bridges and buildings had a proper understanding with the operator at Crab Orchard. In view of this, the assistant roadmaster communicated by telephone with another operator at Crossville, 15 miles west of Ozone, and understood this operator to say that No. 2 was then at Crossville. However, in the investigation, the operator at Crossville stated that he was not questioned with respect to the movement of Train No. 2, but that he was asked for information regarding the movement of Train No. 60, and that he informed the assistant roadmaster that No. 60 was then at Crossville. Actually, No. 2 had departed from Crossville at 1:45 p.m., after receiving copies of a train order establishing Dorton as the meeting point between No. 1 and No. 2. The bridge and building supervisor said that he had informed the general roadmaster that No. 2 was to meet No. 1 at Dorton. The assistant roadmaster said that his understanding was that the trains were to meet at Crossville.

The information obtained by these employees with reference to the train movements was not in writing and was not repeated to either of the operators from whom it was obtained. The occupants of the motor car did not have a correct understanding of the location of No. 2. This train was due to leave Crab Orchard, the first station west of Ozone at 2:03 p.m., and was due to leave Ozone at 2:13 p.m. The motor car departed from Ozone about 2:13 p.m., on the time of No. 2, and was moving at a speed of about 13 m.p.h. about four minutes later when it collided with the engine of No. 2. At the point of accident the alignment is on a six-degree

curve, 850 ft. in length, on which, because of an embankment, the view is restricted to about 150 ft. The assistant roadmaster first saw the engine of No. 2 about 150 ft. distant and called a warning to the other occupants of the car, and then jumped just before the accident occurred. The general roadmaster was killed.

No. 2 approached the point of accident at a speed of about 30 m.p.h. and both members of the engine crew were maintaining a lookout ahead. However, because of the restricted view, the first indication they had of the movement of the motor car was when the fireman saw it about 150 ft. distant.

### The L. & N. Accident

The accident on the L.&N., in which five members of an eight-man track gang were killed, occurred on that part of the Evansville division extending between Henderson, Ky., and Hopkinsville, 73.29 miles, a single-track line over which trains are operated by timetable, train orders and an automatic block-signal system. It occurred on the main track 44.3 miles south of Henderson and 0.8 miles north of the station at Morton, on a 2-deg. curve 1230 ft. in length.

The section force at Earlington, Ky., 3.5 miles north of Morton, was called for emergency work and was instructed to proceed by motor car to a point known as Nortonville, 3.5 miles south of Morton, to assist in making repairs to the track in that vicinity. About 8:40 p.m. the train dispatcher issued a line-up to the operator at Earlington with information regarding train movements in this territory. This line-up included information to the effect that Engine 1532 was then in the yard at Morton but, because the dispatcher had not been informed when this engine would depart from Morton, no mention was made in the line-up regarding its movement.

The section foreman obtained the line-up in writing from the operator about 8:50 p.m. and, about five minutes later, the motor car, coupled to a trailer, departed southward from Earlington. The foreman and four laborers rode the motor car, on the front of which two lighted white lanterns were displayed, and three laborers rode on the trailer.

Engine 1532 departed northward from Morton at 9:05 p.m., with the engine in backward motion pushing one car and a caboose. The flagman was riding on the leading platform of the caboose and a lighted white lantern and a lighted red fusee were

(Continued on page 55)

Near Right—The Fire at This Warehouse is Beyond Control. Far Right—That the Problem of Fires in Bridges is Yet to be Solved Was Demonstrated on December 6 when this 1000-Ft. Timber Trestle on the Main Line of the New York & Long Branch Was Completely Destroyed



DURING 1945, the railroads of the United States reported to the Fire Protection and Insurance Section of the Association of American Railroads a total of 5,245 fires on their

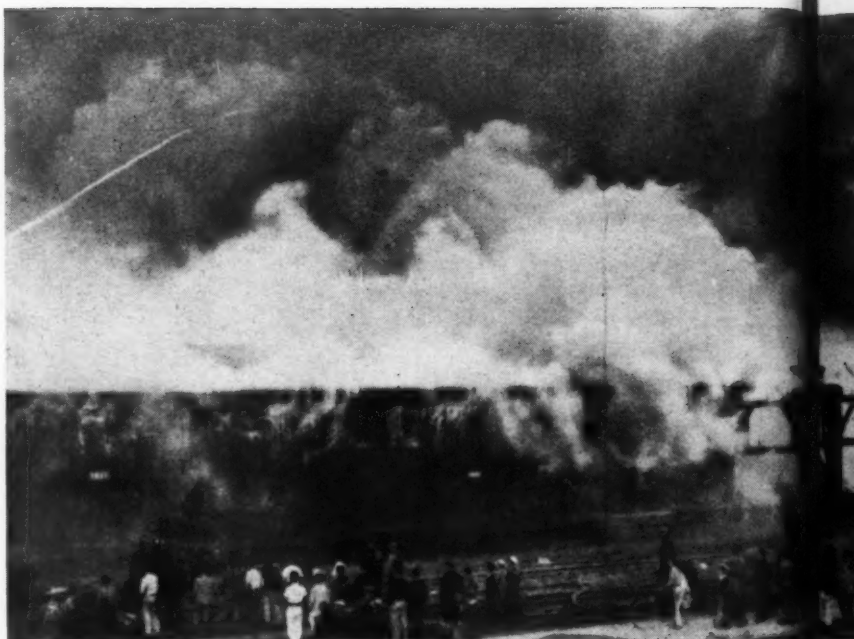
properties, representing a physical loss of over \$7,000,000. This loss does not, however, in any way represent the out-of-pocket cost to the railroads, as it does not include the entire cost of rebuilding the facilities destroyed, the loss of use, or the full replacement cost of machinery or stores stock. In the case of traffic interruptions, it does not include the cost of detouring trains, the cost of making repairs under traffic, or the overtime work necessary to get the trains rolling again.

A classification by causes of these 5,245 fires follows:

	No. Fires
Power (sparks, hot coals, etc., from locomotives, hot boxes, etc.)	1,095
Cause unknown	1,083
Miscellaneous, (smoking, derailments, etc.)	1,048
Outside cause (lightning or fires originating in adjacent buildings)	778
Heating (stoves, sparks from chimneys, etc.)	629
Occupational (acetylene torches, burning right of way, etc.)	511
Lighting	101

A recapitulation of these fires by types of facilities or properties shows the following: 2,177 fires—freight cars; 1,126 fires—non-fire-resistant building structures; 538 fires—passenger cars; 347 fires—not separately classified; 280 fires—bridges, trestles, etc.; 245 fires—timber, ties, etc.; 241 fires—locomotives (steam and others); 87 fires—fire-resistant building structures; 83 fires—snowsheds, fences, tunnels; 281 fires—miscellaneous.

The responsibility for providing fire protection at various locations lies with our higher officers. The only thing we can do as supervisory



## Preventing Fires in R

By HERBERT I. BENJAMIN

Vice-Chairman, System Committee on Insurance  
Southern Pacific Company

officers is to recommend the type of installation that is best suited for the specific conditions. There are so many different types of fire-fighting equipment, each of them adapted to certain specific purposes, that to make a broad plan of installation of any one type for all locations is out of the question. Therefore, each location presents its own problem and should receive special study before recommendations and installations are made.

### Supervisor's Responsibility

There are many things which supervisory officers can do in the matters of fire prevention and fire control. After the management has approved a plan and appropriated the money for the purchase and installation of fire-fighting equipment, the duty of the supervisor is not only to supervise the installation so that it will do the work for which it was designated, but also—what is more important—to maintain it properly.

Fire pumps should be tested periodically to see that they function properly. There have been a number of cases of hose lines bursting as a result of the water pressure being suddenly increased at the time of a fire. For this reason hose lines also should be tested regularly and, after use, should be dried and put away properly. Valves that are to be used in case of a fire should be plainly marked and instructions for their operation should be prominently posted.

Fire extinguishers should be charged at regular intervals, tagged, and occasionally tested to see if they are operative. The matter of where to locate extinguishers should be given careful consideration to the end that they can be found quickly when it becomes necessary to use them. This is so because it is important that fires be extinguished in their incipency and before they have done serious damage.

So much has been said about cleanliness and good housekeeping that



(Acme Photo)

## Railway Structures

there is a tendency on the part of many men to consider that advice along this line is needed by everyone except themselves. Foremen and other supervisors have the responsibility of seeing to it that cleanliness and good housekeeping are maintained, because, when a man becomes negligent in his housekeeping habits, fire hazards are created. Such transgressions should be corrected at once and it should also be pointed out that good housekeeping promotes good work, whereas untidiness and dirt lead to careless and generally unsatisfactory work.

### Labor Camps

In bunkhouses, company dwellings, outfit cars, etc., it is the duty of the supervisor to look for and immediately correct unsafe practices. Wet clothes should never be hung around or close to a hot stove. Oily rags should be taken away and burned; hot stoves should not be left unattended; metal protection around stoves should be properly maintained; and flues should be examined and kept safe. Care should be taken when filling lamps to see that they are in good condition and safely located.

Supervisors should never take anything for granted, but should ascertain that rules are being followed and that unsafe practices are eliminated at once. It is important that employees be instructed in the proper procedure to follow in case of fire. How many men actually know the location of fire-fighting equipment? How many men know how to use such equipment expeditiously or with the best results? A recent fire in a store and office building indicates the nature of the answers to these questions. When fire was discovered, one of the men ran to the alarm box and broke the glass without opening the inner door, and then ran back to the fire. Not hearing the alarm, another man ran to the alarm box, opened the door and pulled the lever, holding it down awaiting the alarm. After about a half minute he released the lever, ran back to the fire and then heard the alarm. The delay of three or four minutes in transmitting the alarm resulted in the total loss of the facility, whereas, if the men had known how to operate the alarm box, the loss would have been held to a minimum.

Cleanliness should prevail when work is done around bridges. Foremen should see that accumulated

Some valuable pointers, addressed especially to supervisors, on how to minimize losses to railway property by fire are contained in this article which was presented originally as a paper before the 1946 convention of the American Railway Bridge and Building Association. Following a general discussion of the subject, Mr. Benjamin takes up separately the several classes of fires, grouped by the different categories of structures, pointing out the fire hazards involved and how to reduce them.

debris is taken a sufficient distance from the job, so that if it catches fire, the structure will not be endangered. When the work has been completed and final cleanup is made, extreme care should be used to see that all waste material is disposed of or burned at a safe distance from the structure. This is particularly apropos today, because of the universal use of creosoted material. I have heard of a newly-completed ballast deck structure that was completely destroyed by fire because, when the debris being destroyed was left burning unattended during the night, a change in the direction of the wind blew sparks toward the structure, setting it on fire and causing it to be completely destroyed.

Always bear in mind the three important items in eliminating fire losses: (1) Do not tolerate conditions that will start a fire; (2) put

out a fire in its incipency—the first three or four minutes are important; and (3) wherever possible, get trained help at once to assist in putting out a fire.

We will not go into detail here regarding the means of fire prevention, nor is it possible to make specific recommendations as to the type of fire-fighting equipment that should be used at each location. There are many varieties of such equipment, some of which were developed during the war by the Army and Navy, and each of them is good for its specific purpose.

### Classes of Fires

The several classes of fires in railroad property, which result not only in physical losses but also in costly losses not measurable in dollars and cents, are as follows:

**Class 1—Bridges, trestles, tunnels and snowsheds.** Damage to or destruction of any of these structures interferes with the normal flow of traffic and, therefore, they are more important to railroad operation than other types of facilities. Fire protection for such structures is naturally somewhat different than for shop or other facilities, which usually have the benefit of the proximity of municipally-owned fire departments. Structures in Class 1 are frequently

products on the market which can take the place of paint for covering timber surfaces. One of these, although it is a petroleum product and inflammable while being applied, makes a binder to hold together a heavy coating of pea gravel or rock chips. The latter, which must pass through a  $\frac{3}{8}$ -in. sieve and be washed to make them dust free, are applied while the binder is hot. When cold, the combination forms a coating somewhat like a tar-and-gravel roof. It has been found that coatings of this type can be applied to creosoted material, providing the latter has weathered enough to leach out the oil. The application of metal checkered plates on wood surfaces and the use of hand rails of steel will also help eliminate fire hazards in key structures.

Ballast-deck structures are afforded protection against fire from the top, but if they extend over dry washes, there is always a hazard of fire from underneath. Consequently, all vegetation must be removed from around the bents and the ground scarified in the vicinity before the dry season starts.

Water barrels, each having a bucket hung on the inside, should be placed at specified intervals along a structure and kept filled. Key structures can be given special consideration and protection. If water is avail-

Frequently this practice is less costly than to reline the tunnel under traffic, particularly in view of the availability of modern earth-moving equipment, and also has the advantage of eliminating the fire hazard.

### Snowsheds

Snowsheds present another fire-protection problem. Very few railroads have snowsheds—the Southern Pacific probably has more such structures than all other railroads combined. When snowsheds are constructed of wood, they should be provided with fire breaks. This can be accomplished by constructing 100-ft. sections of the shed in concrete at intervals or by constructing wood sections that can be removed or rolled back during the summer season. Definite breaks in the continuity of snowsheds constitute another method of fire protection. Usually, water is readily available where snowsheds are used, and the installation of sprinkler systems, by means of which shed roofs can be sprinkled at least twice a day during the summer months, does not present much of a problem. Such a system has been installed in a snowshed on the Southern Pacific Overland route and our experience with its use shows that the relative humidity within the shed is raised sufficiently to make the spread of a fire improbable. A fire train is also kept in readiness at this location, and a reliable watchman and an alarm system cover about 40 miles of snowsheds.

### Shops and Stores

**Class 2—Shops and store buildings.** Neither the B.&B. supervisor nor the roadmaster has very much jurisdiction over this important classification of fire losses. Such facilities are concentrated and values run high. Unless controlled in its first stages, a fire may result in a conflagration, destroying valuable buildings, machinery and supplies. Wood floors in buildings in these areas should be replaced when badly splintered, and holes in platforms should be repaired. Here, also, good house-keeping and the careful disposition of working materials are most important in preventing fires, and all supervisory officers should be fully cognizant of these facts, being always on guard against fire hazards.

Fire-protection equipment in the form of hand extinguishers, strategically placed and regularly maintained, provide first-aid protection against incipient fires in this classification, but the importance of call-

(Continued on page 58)



A Frame Passenger Station in An Advanced State of Destruction by Fire

in isolated locations, and, therefore, they should be made as fire resistant as possible.

Where it is not possible to give the structure complete immunity to fire, the parts that are subject to ignition should be given some form of protection. A heavy coat of paint with sand applied while the paint is wet has always been considered good protection. However, such a protective coat is not infallible because ties do check, producing openings which may be entered by a cigarette or spark. There are now numerous

able, an automatic or manually-operated sprinkler system can be installed, which will do much towards eliminating fires.

Tunnels, when wood-lined, should have concrete portals and at least 50 ft. of length concreted at each end so that a brush fire burning on the outside will not ignite the lining. It is important to remove all vegetation from around the portals of such tunnels. Also the replacement of tunnels with open cuts should be considered in cases where the lining has reached the end of its service life.

Presented originally as an address before the 1946 convention of the Roadmasters' and Maintenance of Way Association at Chicago, this article first endeavors to show how clean ballast increases the stiffness of the track structure and thereby reduces the amount of power wasted through wave action. Next it discusses the theory of capillarity and explains how this process causes the subgrade and ballast to become saturated and, conversely, how capillary action is reduced in clean ballast. Also, it deals with various aspects of the problem of cleaning ballast.

# The Why and the How of Ballast Cleaning

By H. W. PROTZELLER

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**BALLAST** cleaning is rapidly becoming a *must* item of track maintenance. In 1945 a large eastern trunk line reported that it spent \$250,000 for this purpose.

When the cost, on one railroad alone, of a single item of track expense reaches such a vast sum, it is of vital importance that the means and methods for performing the work be considered very carefully to the end that maximum efficiency and economy may be attained.

Until the present, cleaning has been confined mostly to crushed stone and slag ballast. As the benefits of ballast cleaning become more widely known, and as it becomes less feasible to raise track by introducing a layer of new ballast over the old, the necessity and practicability of cleaning other types of ballast will increase. Undoubtedly,

therefore, much experimental work in cleaning gravel ballast will be undertaken in the near future. If we seem to confine our conclusions to stone ballast, it is because data are available for this material while very little is known, as yet, of the cleaning of other types of ballast.

## Functions of Ballast

The Railway Engineering and Maintenance Cyclopedic states: "Ballast consists of selected materials placed on the roadbed for the purpose of holding the track to line and surface." The cyclopedic lists five functions of ballast: (1) To provide a firm bearing for the ties, thus distributing the load evenly over the roadbed; (2) to provide adequate drainage of the track structure and thus prevent "puddling" or "pumping" track; (3) to fill the spaces between the ties and to form a shoulder between the ends of the ties and the toe of the ballast slope, thereby holding the ties in the proper position; (4) to



Track Stiffness, Says Mr. Protzeller, Is Enhanced by Clean Ballast with Resulting Considerable Savings in the Power Required to Overcome the Drag on Locomotives Caused by Wave Action

retard growth of vegetation within the limits of the track; and (5) to facilitate track work during periods of wet weather.

All of these functions would be complied with if solid concrete were used instead of ballast, but experience has proved that rigid concrete track structures do not perform satisfactorily and are of little practical value. Therefore, ballast *must* perform some additional functions.

With modern rolling stock, moving at high speeds, it is essential that the ballast provide a resilient or elastic support for the track. Two of the greatest enemies of good ballast are water and dirt, which combine in the ballast to form mud. Much of this water comes up from the lower roadbed section by capillary action and, under the proper conditions, ballast can eliminate or materially reduce this action. Consequently, two additional functions of ballast are: (6) To pro-

ide a resilient and elastic support for the ties and rails; and (7) to afford a means for the elimination or reduction of capillary action. Ballast cleaning is closely related to these two functions and a detailed analysis of each is warranted.

### What Is Elasticity?

Practically all materials possess a certain degree of elasticity. Up to a certain point, called the elastic limit of the material, a body deformed under stress will return to its original shape when the stress is removed. The ability to do this is known as elasticity. If the stress is increased beyond the elastic limit, the body undergoes a permanent "set". Therefore, it is extremely important that the materials employed in any load-carrying structure are not stressed beyond the elastic limit. Within the elastic limit a definite ratio exists between the unit stress, or load, and the amount of the deformation or movement of any material, this ratio being termed the modulus of elasticity.

Stone suitable for ballast has a minimum modulus of 5,000,000 in tension or compression and 2,700,000 in shear. When a large stone is broken up into small pieces, each of the pieces retains the modulus of elasticity of the parent block, but when the mass of small pieces is compacted together to

form a load-carrying element, the modulus of the mass is quite different from that of the individual pieces. We may consider that the modulus of an individual piece of stone is dependent upon the movements of the molecules within the piece. Under the same reasoning, we may consider that the modulus of the mass of stones is dependent upon the movement of each of the small pieces against each other.

It is obvious that, when many small pieces of stone move and rub against each other, the amount of the movement will depend on the friction between the surfaces that touch one another. In crushed stone ballast this friction determines the load-carrying ability of the ballast section and governs the amount of movement of the individual pieces. To prove this, place a heavy weight on a pile of clean, dry crushed stone. A relatively small movement of the individual pieces will result and the pile will return to its original shape when the weight is removed. If the pile is saturated with a lubricant and the weight again placed on it, the movement will be much greater and the chances are that the pile will not return to its original shape. Therefore, we can state that the modulus of elasticity of crushed stone depends on the cleanness and dryness of the individual pieces or on the amount of lubricant on their surfaces. Water and mud form lubricants for crushed stone.

the entire track structure depressing under the load and rising again to its original height when the load is removed. If this movement is measured carefully, it will be found that, under average conditions, approximately 10 per cent of the total depression is absorbed by the elasticity of the rails, and ties, leaving 90 per cent to be absorbed by the ballast and the roadbed.

If the tie bottom is bearing firmly and evenly on the ballast bed and the ballast is being depressed 90 per cent of the total movement, then the depression of the ballast decreases with depth until, at some point below the tie bottom, it becomes zero. This movement of the ballast is, to a large extent, absorbed by the lateral movement of the individual pieces as well as by the downward movement. As mentioned previously, the movement of the pieces of ballast depends upon the friction between them. The greater the friction the more elastic the ballast and the quicker the motion is stopped. On the other hand the more mud and water are contained in the ballast the farther the downward movement progresses.

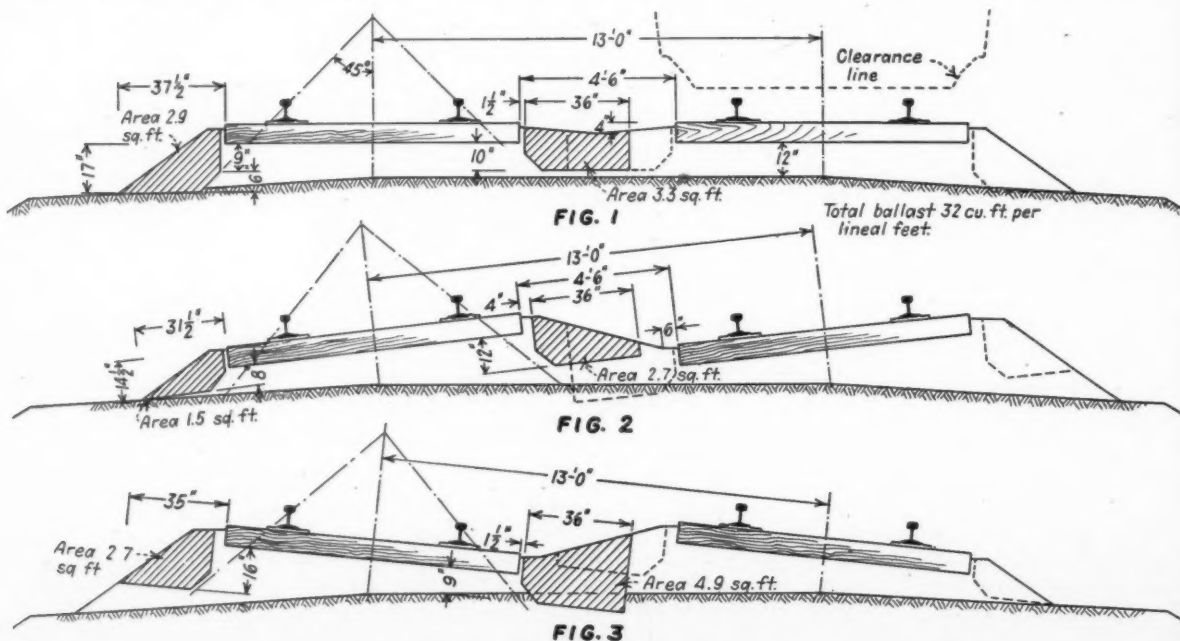
### Track Stiffness

The amplitude of the vertical movement that occurs during the wave action of the track depends on the load, the weight of the rail and the elasticity or stiffness of the track structure as a whole. Track stiffness is measured by the load, in pounds per inch of rail length, required to depress the top of the rail one inch. If a continuous load amounting to 2,000 lb. per inch of track (both rails) depresses the rail

Mr. Protzeller's Recommendations Regarding the Areas of Ballast to be Cleaned on Tangent and Curves in Double-Track Territory Are Shown in These Drawings

### Track Elasticity

When the wheels of railway vehicles pass over the rails, a wave action of the rails takes place caused by



one inch, the track stiffness is said to be 2,000. Track with a stiffness of 2,000 is considered as being quite soft, comparable to 131-lb. rail, with 24 ties per 39-ft. rail length laid on cinder ballast. Track consisting of firmly-tamped stone ballast under 24 ties per 39-ft. panel and 131-lb. rail, has a stiffness of approximately 8,000 when the ballast is clean and dry.

When a train moves along the track the wave action produced is such that each car may be considered as causing one and one-half full depressions of the track. On stiff track (8,000) the depth of a full depression is approximately 0.16 in. and on soft track (2,000) it is approximately 0.4 in. This is based on a rail weight of 131 lb., 24 ties per rail and an axle load of 40,000 lb. Under these conditions, the average total downward pressure at each tie is 11,000 lb. on the soft track and 16,000 lb. on the hard, firm track.

### Wave Action Wastes Power

Whenever a load is moved work is performed. When the track is depressed all of the work performed is wasted, causing a direct drag on the locomotive. On the basis of the foregoing analysis, the wasted energy on soft track is 183 foot-pounds per depression and on good firm track it is 107 foot-pounds. A 100-car train depresses the track 487,500 times in one mile, assuming 3,250 ties per mile and 150 depressions for the 100 cars. If the cars have a 40,000-lb. axle load, this means the locomotive must supply 2,700 additional horsepower to overcome the track resistance on track with a stiffness of 2,000. On the 8,000 stiffness track this additional power requirement drops to 1,580 locomotive horsepower.

Proper ballast-cleaning materially increases the stiffness and the resiliency of track by removing the mud and water which lubricates the ballast. Because many trains pass over a track in the course of a year and, because locomotive horsepower can be converted directly into money, it is apparent that ballast cleaning is a very valuable maintenance item.

### Capillary Action

The natural phenomena which causes liquids to rise in small tubes in defiance of the law of gravity is known as capillary action or capillarity. Jurin's law of capillarity states that for "the same liquid and the same temperature, the mean height of the ascent in a capillary tube is in inverse ratio to the diameter of the tube." In other words, the smaller the diameter of the tube, the higher the liquid will rise.

A study of capillarity reveals that water rises higher than other liquids, that its rise is independent of the tube shape and that this rise decreases as the temperature increases. Provided the water wets the walls of the tube, the rise is independent of the thickness of the tube or the material of which it is made. A capillary rise of water may occur between two adjacent flat surfaces, but in such a case, the

by capillarity. This water has a decisive influence on the elasticity and load-carrying ability of the ballast.

When heavy loads pass over stone-ballasted track in which the voids of the ballast have become clogged with dirt, a movement of the stone particles takes place and a grinding action between the surfaces of the stones results. This grinding action reduces the dirt in the voids to a fine silt which

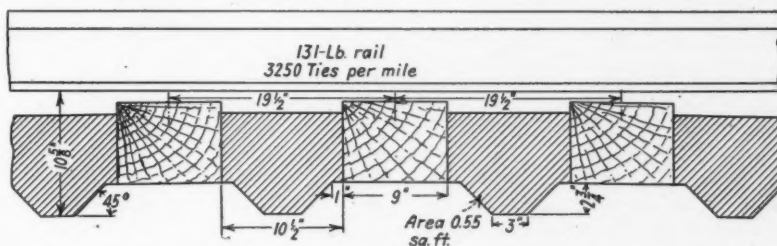


Fig. 4—Recommended Sections of Ballast to be Cleaned in the Cribs

ascent is only half as high as would occur in a tube whose diameter is equal to the distance between the flat surfaces.

A capillary rise of water will occur in all materials which have pores of a perceptible size. The smaller the pores, the greater the rise and when the water penetrates into materials such as wood, clay, silt and chalk, the air in the pores is driven inwardly with such force that its pressure may rise to four or five times atmospheric pressure. This increase of pressure may cause the water to rise to much greater heights than it would in an ordinary tube. Also capillary water exists in most soils or earthy materials as a thin coating on the minute particles of the material. Such water moves from a wet soil to a drier soil in any direction.

The capacity of soils to hold capillary water is usually reached when the weight of the water amounts to 15 to 20 per cent of the dry weight of the soil. The distance which water may be drawn upwardly by capillarity alone varies from two feet for sands to five feet for dense clays.

Repeated applications of pressures on soils, especially those with fine pores, such as silt or clay, greatly increase the heights to which water will ascend. This is demonstrated by the fact that patting the top surface of a cube of moist clay with the hand at a rapid rate causes the surface soon to become quite moist. By continuing the patting a considerable amount of water will be brought from the interior of the clay to the surface.

Ordinarily we think of water in the ballast as having collected there from rainfall. As a matter of fact, however, most of the water in saturated ballast actually comes up from the subgrade

packs together into a compact mass, forming an ideal workshop in which capillarity may do all of the things mentioned above.

The bottom of the ballast bed is in intimate contact with the subgrade below, which usually has an abundant supply of water. Capillary action in the compacted soils of the subgrade cause this subterranean water to rise. Because the compacted soil is porous, an internal pressure is built up, which increases the amount of the capillary rise. Then the vertical movement of the ties, caused by wave action, results in a patting action on the tie beds, thereby enabling the water to rise still further. Finally, the water reaches the ballast section where it saturates the ballast in a very short period of time. Because the ballast voids have been filled with fine silt and water, the load-carrying ability is decreased and the magnitude of the track depressions thereby increases. This merry-go-round may continue until the track becomes practically unfit for traffic.

### Water in Fills

The height to which capillary water may rise in the track structure is almost unbelievable. Every track man knows of stretches of wet track on high fills that remain wet during long periods of drought. It has been definitely proven that capillary water will rise in such fills from depths of more than 50 ft. below the ties.

Trenches have been dug across the roadbed at many wet locations and the materials so excavated have been examined thoroughly. Often the materials appear to be quite dry and it is a natural conclusion that little, if any, water is rising into the ballast from

the subgrade. This is erroneous. Although a soil may hold capillary water amounting only to 15 to 20 per cent of its dry weight, a great volume of water may pass through the soil in moving upward. Also, the apparent lack of water in the soil under wet ballast is due to the fact that, because the soil is dug up rather slowly, its capillarity is destroyed, causing the water

to remain approximately 32 cu. ft. of crushed stone per lineal foot of roadbed. When in solid blocks the stone used for ballast weighs approximately 165 lb. per cu. ft. After this stone is broken up and compacted in the track, the entire mass is approximately 65 per cent stone by volume and 35 per cent voids. Thus the average cubic foot of ballast in track weighs 107



Fig. 5—About 3.25 Cu. Ft. of Dirt Will Be Removed From Each Lineal Foot of Track

that would normally be passing upward through the soil to disappear downward in a short time leaving relatively dry material.

### Cleaning Curbs Capillarity

If ballast is properly cleaned, most of the dirt and silt in the voids will be removed and, with the voids opened, capillary action cannot take place. Since capillary water will move in any direction from a wet area into a dry area, the water in the uncleaned portion of the ballast will move, or leach, toward the clean area, which is dry, and will carry with it much of the fine silt from the wet area. As this silt is removed from the clogged voids of the uncleaned ballast, the capillary action decreases over the entire roadbed.

Rainfall will promote additional leaching of the silt and dirt in the dirty ballast thus reducing capillary action still further. When the tie beds have been drained of water, the elasticity of the ballast returns, the patting action of the ties is reduced and the tendency to draw more water up from the subgrade is lessened.

### Ballast Cleaning

The practice of cleaning ballast originated shortly after crushed stone was first introduced as a ballast material. For many years hand-cleaning methods were used, and practically all of the work was confined to wet spots, usually around joint ties. Mechanical means were later adopted, and permitted a much greater volume of cleaning than was possible with hand methods. The greatly increased cost and lower efficiency of present-day hand labor, and the enormous volume of cleaning to be done, require the use of modernized mechanical equipment which will do a better job in less time and at a lower cost.

The average double-track line con-

tain approximately 8,940 tons per mile. The average weight of the dirt and silt accumulating in the ballast is 70 lb. per cu. ft. and, when the voids are completely filled, the dirt averages 2,067 tons per mile.

### How Much to Clean

Obviously, to do a 100 per cent job of ballast cleaning, the track should be removed and *all* of the ballast thoroughly cleaned. Since this is not possible, the most practical procedure is to clean as much of the ballast as possible without damaging the stability of the track. Although we may assume that cleaning all of the ballast will produce a 100 per cent job, the effectiveness of cleaning only a portion of it will not vary in direct proportion to the amount cleaned. Actually, if the shoulders, cribs and inter-track spaces, representing only about 40 per cent of the total ballast, are cleaned, the work will be more than 60 per cent effective. This seeming paradox is due to the almost complete destruction of capillarity in the entire ballast section.

It is the writer's opinion that each track should be handled as though it were a single track, regardless of whether it is in multiple-track territory. Mechanical cleaners should not, therefore, disturb the ballast nor foul the traffic on the adjacent tracks (See clearance diagram, Fig. 1). Also, to maintain the general stability of the track, a fundamental rule that should never be violated is that the ballast confined between lines drawn at angles of 45 deg. from a point on the center line above the track through the gage corners of the rails should not be disturbed (See lines O-A, Figs. 1, 2 and 3).

Because the mud in ballast frequently collects around the ends of ties to form a compact "dam" or "stocking," many people have the idea that, in ballast cleaning or scarifying,

the ties should be under-cut for three or four inches to break up such formations. This is a serious mistake and will soon result in a weakened track structure. Under no condition should the ballast of the shoulder or the inter-track spaces be excavated closer than 1½ in. from the ends of the ties. In fact, on the high sides of curves this distance must be increased. Likewise, the lower corner closest to the ties should be excavated at an angle of 45 deg. (See Figs. 1, 2 and 3). If the wings or plows of the ballast cleaner are properly made they will exert both a lateral and an upward pressure, which will break up the mud stocking without affecting the track stability.

In general, the depth of cleaning depends on the amount of ballast under the ties, the character of the subgrade material and whether the track is tangent or curved. The shoulders should be cleaned to the level of the subgrade at the ballast toe, but the inter-track spaces should not be excavated quite so deep. By keeping the "floor" of the inter-track space at a higher level than that of the shoulder, a certain amount of under-track cross drainage is provided. Otherwise, unless cross-drains are located at frequent intervals to permit quick drainage, the inter-track spaces will act as catch basins for the mud and silt leaching out from the cribs and ballast bed. A depth of 10 to 12 in. below the tie bottoms for the inter-track spaces is desirable in most cases.

Fig. 1 illustrates the best practice in cleaning shoulder and inter-track ballast on tangent track. The cross-hatched areas indicate the ballast to be cleaned for Track No. 1, while the dotted lines show the proper areas for Track No. 2, Figs. 2 and 3 giving similar information for curves to the right and left respectively. It will be noted that there is some overlapping in the cleaning even in the inter-track space. This is necessary because of uneven tie lengths, variations of the inter-track width, and to provide for properly handling the ballast.

The total volume of shoulder and inter-track ballast to be cleaned on one track amounts only to 6.2 cu. ft. per lineal foot of track. This is approximately 33,000 cu. ft. per mile, amounting to 1,765 tons of crushed stone and 404 tons of dirt. It is thus apparent that ballast cleaning requires the handling of immense volumes and weights of materials.

### Crib Cleaning

Many maintenance men claim that after the shoulder or inter-track spaces have been cleaned, the silt and dirt in the cribs will leach out into these

areas, making it unnecessary to clean the crib ballast. This is only partially true, because the leaching depends largely on the character and amount of dirt in the crib ballast. The average crib contains 4.5 to 5.0 cu. ft. of ballast, equivalent to approximately 3 cu. ft. per lineal foot of track.

### Amount of Leaching

On level, tangent track it is reasonable to assume that approximately half of the leaching from the cribs will be deposited in the shoulder space and the other half in the inter-track space. If the ballast is 35 per cent dirt by volume, approximately one cubic foot of dirt must leach out per lineal foot of track. Some of the ballast directly under the ties must be leached free of dirt and silt if all of the benefits of ballast cleaning are to be secured. If all of this dirt leaches out into the shoulder and inter-track spaces, the voids in those portions of the ballast will quickly fill up and the leaching action will cease. On curves, the tendency is for the leached dirt and silt to accumulate on the low side of the track, with the result that the withdrawal of dirt from the crib section stops very quickly. If the cribs are not cleaned, then the shoulder and inter-track spaces should be cleaned frequently. In general, because crib cleaning is expensive, it is good practice to clean the cribs about half as often as the rest of the ballast section.

No mechanical means are as yet available for excavating, cleaning and redepositing the crib ballast, but machines for excavating the cribs and depositing the ballast on the shoulders or in the inter-track spaces, where the ballast cleaners can pick it up, have been developed. By the use of such excavators it is possible to clean the crib ballast at a small fraction of the cost of hand-cleaning methods.

### Must Observe Caution

It is necessary to observe caution when the cribs are excavated, to prevent weakening the track structure. For the best results, the cribs should be excavated for several inches below the bottoms of the ties, but without disturbing the ballast bed under the ties. The excavation should begin approximately one inch from the bottom edge of the ties, as shown in Fig. 4, and then slope downward at an angle of 45 deg. toward the center of the crib. The slime and muck usually found beneath the ties will then work out into this prepared trough and much of it will drain off into the space beyond the tie ends.

When the crib ballast is excavated,

the total volume of ballast to be cleaned is increased to 4.8 cu. ft. per lineal foot of track in the inter-track space, and 4.4 cu. ft. on the shoulders, or a total of 9.2 cu. ft. This amounts to the immense total of 3,200 tons of foul ballast per mile of single track. All ballast-cleaning equipment should be rated on the tons of foul ballast that can be handled per hour, and not on track footage.

It is difficult to rate the quality of a ballast-cleaning job. Good ballast cleaning should remove 85 to 90 per cent of the foreign material in the ballast. When the dirt consists primarily of dry, front-end cinders, nearly all of it is easily removed. However, when the dirt accumulation is mixed with sticky clay particles from the subgrade, it is frequently impossible to remove more than 25 per cent, using the same cleaning means. When wet, sticky clay is encountered, a good practice is to make two runs through the area, disregarding the amount of dirt removed on the first run. The first run will open the voids, and the ballast will swell appreciably, aerating the clay which will dry to such an extent that, on the second run, most of the dirt will be removed. When making two runs, the shoulder and inter-track spaces should be cleaned once before the cribs are excavated.

### The Dirt Problem

The pile of dirt accumulating when the shoulder, inter-track and cribs are cleaned will amount to approximately 3.25 cu. ft. per lineal foot of single track as indicated in Fig. 5. This dirt weighs 70 lb. per cu. ft., and will aggregate 635 cu. yd., or 606 tons per mile. One eastern trunk line reports that on one four-track line, 114 miles in length, 6,800 cars of dirt are extracted from the ballast every year. The disposal of the dirt is often the greatest problem of efficient ballast cleaning.

Dirt removed from the ballast should be deposited not less than 20 ft. from the nearest track center. It should never be deposited in cuts, unless it is removed within a day or two and, if deposited on fills, it should be placed well down the bank. When dirt from the ballast is piled along the track it starts to dry out immediately, and each passing train creates a suction that draws the top layer of this dry dust back onto the track. Frequently, large piles of dirt which were deposited too close to the track have been known to disappear entirely within a few weeks, much of it returning to the ballast from which it had been recently removed at great cost.

The cleaning of ballast is a major

problem that must be economically solved in the near future. The railroads must take the initiative in securing adequate equipment to meet their individual requirements.

## Six Killed

(Continued from page 47)

displayed on this platform. As the train was negotiating the curve on which the accident occurred, its speed was approximately 20 m.p.h. The flagman first saw the white lanterns on the motor car when it was about 600 ft. distant, and he immediately applied the air brakes from the platform of the caboose, but the accident occurred before the train could be stopped. The foreman and four laborers were killed.

Because of an embankment on the inside of the curve, the view of the occupants of the motor car was materially restricted. The surviving members of the gang stated that they saw the reflection of the lighted fusee, displayed on the caboose, just before the collision occurred.

In the investigation of this accident, it was developed that twelve collisions between motor cars and trains have occurred on this division since January 1, 1945.

In its two reports the commission pointed out that during the last two years it has investigated 11 collisions between trains and motor cars. These accidents, it said, resulted in the death of 22 persons and the injury of 20, and were caused by the failure of the railroads to provide adequate protection for the movement of the track cars involved. It was pointed out that in each case the members of the train crews were not informed by train order as to the location of the opposing motor-car movement, and no protection was provided for the motor cars. If adequate train-order protection had been provided for the movement of the motor cars, it said, the accidents might have been prevented. If proper block protection had been provided, it continued, neither the motor cars nor the opposing trains would have been permitted to enter blocks occupied by opposing movements.

Having found that the accidents on the Tennessee Central and the Louisville & Nashville were caused by failure to provide adequate protection for the track car movements, the commission recommended that these roads provide adequate train-order or block-signal protection for the movements of track cars on their lines.

# Cures "Mud Boils" in Tunnel

## With Pressure Grouting

To overcome a highly unsatisfactory track condition in one of its tunnels in Southern Illinois, in which water and disintegrated shale from the subgrade pushed up as mud through the ballast section, the Illinois Central tried pressure grouting with considerable success. In this work, using a special on-track grouting machine, grout was forced into the shale subgrade to a depth of at least six inches to seal off fissures through which water appeared to be pumped by traffic from lower levels. The tunnel conditions and the grouting method used in the treatment are described in this article.

PORTLAND cement grout, used on an increasing scale during the last few years as a means of overcoming troublesome roadbed conditions in open track, was used last year with considerable success in overcoming a muddy track condition in an important tunnel on the Illinois Central, by sealing up tiny fissures in the shale subgrade and tunnel floor, through which water was found to be seeping under the pumping action of traffic. Before the grouting, when the water reached the surface of the subgrade, it mixed freely with particles of disintegrated shale to form a thick mud, which worked up into and completely fouled the ballast section, covering the track with hard, slimy, conical mounds, which continued to grow in size as the action progressed. The result was track that could not be worked and maintained in good surface, and on which even walking was hazardous.

When the nature and cause of the condition in the tunnel had been determined as the result of detailed study, the decision was reached to pressure grout the roadbed affected, which involved more than 3,000 ft. of track and a unique on-track grouting equipment was devised for carrying out this work. With the completion of the work in February, 1945, the former muddy condition within the limits of the ties was entirely eliminated, although at a few locations some mud has continued to push up through the ballast shoulder near the ditches.

The grouting work in question was carried out in Tunnel No. 2 on the Edgewood line of the Illinois Central,



The Grouting Equipment and Crew at the Tunnel Portal

a freight cut-off built about 20 years ago between Edgewood, Ill., 213 miles south of Chicago, and Fulton, Ky., another 169 miles to the south. The tunnel, which is 6,994 ft. long, is a single-track bore, 18 ft. wide, and 23 ft. high, above the top of rail, and is lined throughout with concrete. It has no floor slab, the track being laid on a 12-in. section of gravel, and crushed rock ballast which rests directly on the natural tunnel floor. In the construction of the tunnel, much soft material was encountered, although the predominating formations penetrated were sandstone and shale. The track throughout is on a level grade, and drainage is by means of shallow ditches in the floor on both sides of the track, extending each way from the center of the tunnel to the portals with the grades being such that there is a total fall of two feet in each case.

### Ballast Badly Fouled

For several years after the completion of the tunnel, in 1928, no particular difficulty was experienced with

the roadbed or track. However, in the late 'Thirties the ballast became badly fouled with a muddy substance somewhat like clay, a condition which grew progressively worse until, in 1941, it was found necessary to renew the ballast throughout the tunnel. At the same time, 112-lb. continuous-welded rail was substituted for the 110-lb., 39-ft. rails laid in the original construction.

### Other Attention Necessary

The benefits derived from this work lasted only a short time as mud soon found its way up into the new ballast. This was attributed in part to the heavy war-time traffic that moved through the tunnels, but as the mud was present only in certain definite sections, it appeared more likely due to the character of the subgrade at these locations.

At the various muddy stretches, the combined lengths of which totaled about 3,000 ft., the ballast soon became completely fouled. Moreover, literally thousands of conical mounds

of mud, or slurry appeared within and alongside the track, which nearly covered the entire ballast section. In each mound a small hole extended up from the bottom, through which, with the passage of each train, muddy water rose to the surface and overflowed at the top. Each time this occurred, a small amount of mud was deposited on the mounds and surrounding ballast, many of the mounds being built up in this manner to heights of 6 to 8 in. The mounds, or "mud boils" as they were called, were so numerous, and the mud of which they were formed so slippery, that it was extremely difficult for the men in the track forces to keep their footing. Moreover, it was difficult to maintain the muddy stretches of track in good line and surface, although no particular trouble was experienced with track settlement.

An analysis of the mud deposits disclosed that they were composed of minute particles of pulverized shale, and further investigation revealed that, where they were prevalent, the subgrade consisted of a shale strata 48 to 87 in. thick, overlying firm sandstone. The surface of the shale had

plaster-of-paris seal was 36 in. thick, air bubbles appeared 15 ft. away in the ditch on the opposite side of the track.

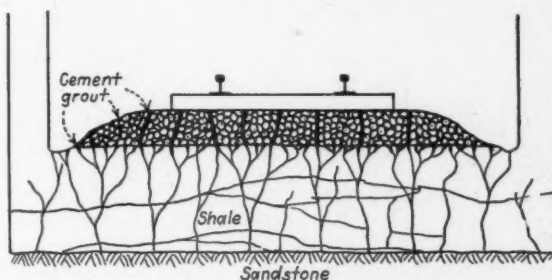
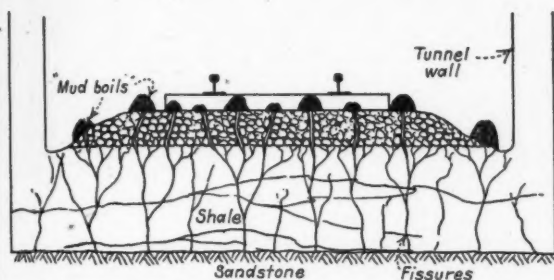
In another test, under traffic, to determine the stability of the track structure, it was found that the entire structure, including the ballast section, depressed  $1/32$  in. with the passage of each wheel load, after which it returned to its original position.

### Fissures in Shale

The results of the tests led to the conclusion that the shale underlying the ballast was permeated to a large extent with tiny fissures through which water, from an unknown source, was finding its way to the surface. Further, it was believed that the track structure in the tunnel acted somewhat like a huge diaphragm, which depressed under each wheel load and created a partial vacuum when it returned to its original position, causing underlying water to be sucked upward through the fissures in the shale where it mixed with the pulverized particles on the surface of the strata to form mud. The mud, it

Therefore, it was decided to attempt to seal the fissures in the shale strata with cement grout to a depth of at least six inches, and thus prevent the upward flow of water to its surface, and also to grout the ballast section to further seal out the mud. It was realized that relatively high pressures would be required to force even a neat grout into the tiny seams in the shale, and, accordingly, it was decided to use a Koehring hydraulic mud jack, capable of high-pressure grouting, for this work.

Since clearance in the tunnel was limited, and the use of extremely long discharge lines objectionable, on-track grouting equipment was deemed desirable. Accordingly, an effective flanged-wheel carriage was improvised for the mud-jack from the chassis of an out-moded weed burner. In this, all parts of the burner, except the propelling engine and fuel tanks, were stripped from the unit, the tanks being retained to be used for a water supply for the grouting operations. A track-mounted air compressor for driving grouting holes, and a trailer car for cement, which were coupled to the chassis, completed the grout-



Cross Sections of the Tunnel Before and After Grouting. Shown in the Left View Are the Fissures in the Shale Subgrade, and the Holes Extending Through the Ballast to the Cones of Mud on the Surface. In the Right-Hand View, the Grout Has Solidified the Ballast Section and Sealed the Fissures at the Top of the Shale Strata

weathered and pulverized, and the tiny particles resulting obviously formed the basis of the mud, or slurry, which was fouling the ballast.

### Investigate Shale Strata

To determine the true character of the shale strata, a number of test holes were dug down through it to the sandstone below. The end of an air hose was then placed in each hole, after which the tops of the holes were sealed with plaster of paris. Then, one hole at a time, compressed air was pumped through the hose into the sealed air space below, and the area surrounding the hole watched for evidence of escaping air. The results indicated that the shale strata was not as solid as originally supposed. For example, when air at 50-lb. pressure was pumped into one hole, in which the

was reasoned, was then drawn upward through the ballast by capillary attraction and the pumping action of the track.

As mentioned previously, no serious trouble had been encountered with track settlement in the tunnel, but it appeared likely that, with the continued disintegration of the shale, a bad condition in this respect might eventually develop. For this reason, and for the safety of those whose duties required them to work in the tunnel, it was decided to take steps to correct the muddy condition. The ideal solution to the problem was felt to be the construction of a concrete floor slab, but this was dismissed as a costly project which would involve a large force and considerable interference to traffic at a time when man-power was at a premium and war freight movements were at their peak.

ing equipment, which moved under its own power and could be quickly run into the tunnel or into the clear at a siding near the south portal.\*

### Rich Grout Used

The grouting of the tunnel floor was begun in November, 1944, and was continued through the winter months without difficulty. In this work it was necessary to use an air hammer to drive hard points for the grout points. The grouting holes were driven at random in rows across the tunnel section, the rows being spaced 42 in. apart so they fall in alternate tie cribs. A rich cement grout was used in the grouting, consisting of 1 sack of cement to 10 gal. of water.

\*A detailed description of this equipment appeared in the December, 1946, issue of *Railway Engineering and Maintenance*, page 1303.

Grout was accepted in nearly all of the holes, usually to the extent of four or five batches, but some of the holes refused it completely. In one a maximum of 19 batches was accepted. It was the practice to pump grout into each hole until it appeared at the surface of the ballast. To accomplish this, considerable pressure was often necessary; up to 300 p.s.i. in some instances.

In some cases the first application of grout did not completely stop the movement of mud to the surface, and it was necessary to go back and inject additional grout. In fact, in a few cases, three or four injections were necessary to effect a complete cure.

In all, five locations within the tunnel, ranging from 50 ft. to 1,210 ft. in length, were grouted, covering a total distance of 3,215 ft., or nearly half of the tunnel's length. In this, 6,136 batches of grout were placed. The cost of this work, including labor, material and work-train service amounted to \$4.07 per lineal foot of roadway grouted.

In the 24 months that have elapsed since the completion of the work, the effectiveness of the work has been clearly demonstrated, although, as was expected, some reappearance of the mud holes has been noted. However, where the mud has reappeared, it has been entirely outside the area between the rails, the new "mud boils" being confined to the ballast shoulders near the side ditches. It is estimated that approximately 85 per cent of the former muddy areas in the tunnel have been completely dried up. Furthermore, the flow of water in the side ditches, which was reduced about 75 per cent with the completion of the work, has increased only slightly since.

During the coming winter, the grouting methods described are to be used in Tunnel No. 3 on the Edgewood Line, about seven miles south of Tunnel No. 2, where similar muddy track conditions have developed. At this time it is planned to return to Tunnel No. 2 and regROUT those locations where the mud holes have reappeared, in an attempt to correct the condition completely.

The roadbed grouting in Tunnel 2 was planned and executed under the general direction of C. H. Mottier, vice-president and chief engineer of the Illinois Central, C. M. Chumley, engineer maintenance of way, and G. M. O'Rourke, assistant engineer maintenance of way, the actual work being carried out under the immediate supervision of C. I. Van Arsdalen, division engineer, R. E. Buss, superintendent of maintenance of way equipment, and L. H. Bond, Jr., assistant engineer.

## Preventing Fires

(Continued from page 50)

ing the fire department immediately should not be overlooked if there is any question at all as to whether the fire can be put out with a single extinguisher.

### Employee Fire Brigades

While the responsibility of fire fighting in a shop area is mainly that of the mechanical department, the bridge and building supervisor has a definite place in the picture. Unless a B.&B. gang has the function of making building repairs in the area and of seeing that extinguishers are properly charged and placed. The responsibility of having extinguishers in good operation at all times and properly charged should be definitely assigned to one of the departments. It is also necessary that fire hose, connections, etc., are kept in good condition, and fire-fighting equipment placed in locations readily accessible and properly marked.

The formation of employee fire brigades, equipped with adequate hose carts, fog nozzles, etc., is good practice around shop grounds for handling small fires and keeping the larger ones in check until city equipment arrives. An employee fire brigade should be familiar with the location of fire hydrants and should work in close co-operation with municipal fire departments. Fire-fighting equipment, such as fog nozzles, motorized fire trucks, O.C.D. pumps and foam generators, can be secured today that will far exceed the efficiency of the equipment used in earlier days.

### Dwellings

**Class 3—Dwellings.** These company-owned structures, furnished for the use of employees, are usually located where no municipal fire department is available, and fire-fighting depends entirely on equipment supplied by the railroad. Here, again, housekeeping is an important item. It is the responsibility of the individual occupying the premises to call his supervisor's attention to any hazard, etc., and to see that safe practices are used. Stove pipes must be properly installed and cleaned annually, and the woodwork around stoves properly protected by metal shields—all of which is the function of the B.&B. department. It is important that the individual occupying such a house should keep lockers and closets clean, and not keep kindling, wet clothes, etc., too near a

stove. Supervisory officers should make inspections at frequent intervals to correct these very hazardous conditions.

### Rolling Stock

**Class 4—Rolling Stock.** The prevailing scarcity of rolling stock makes it imperative that it be preserved and kept constantly serviceable. One of the dangers to be guarded against in this respect is that presented by fires in railroad yards. While, fortunately, there have been but few yard conflagrations in the United States, this is no criterion that such catastrophes cannot happen. Where adequate fire lines are not available in yards, steam switch engines should be equipped with fire hose. Also, water tank cars with pumps and fire hose should be stationed in large yards for emergency use.

Oil and gasoline fires resulting from derailments have occurred on a number of eastern roads, and as a means of protection against such fires it is important that every relief outfit be provided with fire-fighting equipment. Tank cars, filled with water and provided with pumps, hose, fog nozzles or foam generators, are an added protection for fires of this kind. Some of the eastern and southeastern railroads supply this type of equipment with their relief trains.

An important phase of fire prevention and inspection activities on any railroad is the proper organization of the department to which this work is entrusted. While our supervisory officers have their hands full in carrying on their departmental work it is important that they be alert to any possible fire hazard.

Local fire-prevention inspectors, working in conjunction with shop fire chiefs, can best handle local conditions. Monthly and annual inspections should be made to correct bad conditions, and to inspect and test fire-fighting apparatus. Reports of such inspections should be made, wherever possible, to a central office, preferably headed by a general fire inspector reporting to the general manager or some department head. Correction of many undesirable conditions not requiring large expenditures can be handled quickly under this system.

Fire is one of our worst foes, and fire prevention should go hand in hand with other safety work. A little foresight, care and alertness can do much in cutting down losses. Education of the man who will have to give first aid in putting out a fire is most important.

# Maintaining Water Service Facilities—

No. 19 of a Series

The need for more information regarding the relatively new problem of providing and maintaining installations for the fueling and watering of Diesel-electric locomotives and streamlined trains has prompted the inclusion of this installment in the series on maintaining water service facilities. The water and fuel requirements of these types of equipment are considered separately and the characteristics of the facilities needed to meet these requirements are discussed. Helpful suggestions for their proper maintenance are also included.

## For Diesels and Streamliners

By C. R. KNOWLES

Superintendent Water Service (Retired)

Illinois Central, Chicago



Modern Facilities at a Terminal for Servicing Diesel-Electric Passenger Locomotives

THE constantly increasing use of Diesel locomotives and streamlined trains, together with the demand for faster schedules, has necessitated the development of fuel and water facilities to meet the changed conditions. These facilities must be maintained in such condition that they will operate at their maximum efficiency at all times.

The time element is of first importance. Existing facilities at terminal coach yards will often meet the water requirements for coaches and diners with but few changes; however, the faster schedules and reduced time allowed for stops at intermediate stations require facilities for delivering both fuel and water within the limited time allowed for such stops, which is ordinarily not more than three to four minutes. Even at terminals, many roads are providing entirely new facilities for the servicing of their Diesel power and streamlined trains in the interest of greater speed and efficiency in the servicing of these types of equipment.

Among the items to be considered in the design and construction of such facilities are (1) the number of units comprising the individual locomotives to be handled; (2) the number of coaches to be serviced at any one time; (3) the amounts of water and fuel oil required at each point;

(4) the class or classes of locomotives to be served, that is, whether passenger, freight or switcher, or a combination of all three; and (5) the time available for taking on fuel and water. There is a wide variation in the fuel tank capacities of different locomotives, and an even greater variation in the capacities of locomotives and passenger cars. The water storage capacity varies from 135 to 650 gal. on switching locomotives and from 1200 to 2400 on passenger locomotives, and from 125 gal. for coaches to 600 gal. for diners. Diesel freight locomotives have fuel-oil capacities ranging from 1200 gal. to 3600 gal. per locomotive.

### Water Requirements

Passenger locomotives consume more water than freight or switching locomotives as each passenger car requires from 16 to 20 gal. per

hour for heating, which is in addition to the cooling water required for the engines. Assuming an average speed of 50 m.p.h. between terminals, including stops, a passenger locomotive pulling an eight-car train, and with a water storage capacity of 2400 gal., should have sufficient capacity for a 750-mile run. On this basis, water facilities located at 300 to 400-mile intervals should provide sufficient margin for a train of this size. It is the general practice, however, to space the water facilities at shorter intervals. One road operating an eight-car Diesel train over a route of a little more than 900 miles has provided watering facilities at nine intermediate stations where the train makes regular stops, the average interval being approximately 90 miles. An arrangement of this kind permits taking water at selective stops in each direction or, in other words, taking less than the full stor-

age capacity at regular stops to avoid delay, instead of at longer intervals, thereby requiring more time for each stop.

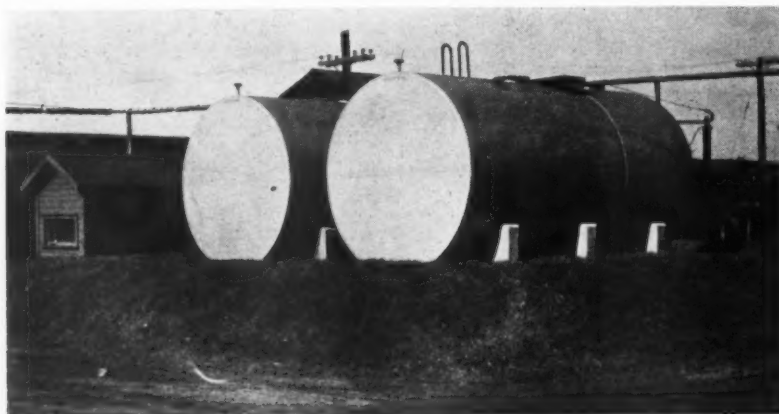
With freight locomotives, in which water is used only for cooling the engines, longer intervals between water stops are possible. For this reason the requirements of the passenger locomotives govern the spacing of water stations. Because of the short time allotted for station stops,

Public Health Service has adopted the following requirements for coach yard and other hydrants handling water for drinking and culinary purposes on land and air conveyances in interstate traffic.

"(1) Hydrants are any one of the following: (a) Overhead crane-type hydrants or above-the-ground water faucets with outlets sufficiently elevated to prevent their exposure to toilet waste discharges from con-

from contamination by ordinary surface drainage. Housing or hood, as referred to above, may be interpreted to include the type of housing used in existing depressed hydrant installations, provided covers are of the overlapping type. In new track installations, this type of hydrant shall be located not less than seven feet from the center line of the nearest track.

"(2) Hydrants, whether of types (a), (b) or (c) embody certain essentials to permit of satisfactory operation and to prevent contamination, such as: (a) Substantial and simple construction, quick opening of the valve, and subject to ready repairs and maintenance in a clean condition; (b) the provision of outlets of ample size to furnish an adequate quantity of water, and equipped with a type of coupling permitting quick attachment or removal of the hose; (c) adequate facilities for the removal of waste water. (In the case of frost-proof hydrants with weep holes, drainage must be provided to prevent surface or waste water rising to the weep-hole elevation); (d) location to minimize the possibility of accidents and contamination; and (e) post hy-



Example of a Modern Installation of Fuel Oil Tanks for Diesel Locomotives

the watering operations must be timed to make every second count if schedules are to be maintained.

#### Passenger-Car Facilities

Facilities for watering the coaches of Diesel trains do not differ materially from those ordinarily designed for watering coaches on steam trains, except as they are affected by the time element. Existing facilities at terminals may often be readily adapted to Diesel service with little, if any, change. Facilities for delivering water to coaches and diners at intermediate stations present a different problem, however, as the facilities must be provided to permit of delivering the required amount of water in the time allotted for regular station stops. This may necessitate installing hydrants for each opening in the cars on each side of the track. Pipe lines of adequate size must be provided to avoid restrictions in flow.

It must be remembered that the combined demand when delivering water simultaneously to the locomotive, diner and coaches may be as high as 600 to 750 gal. per min. Booster pumps are frequently required where the pressure is low. Hydrants should be of the quick-opening type and of such design that there will be a minimum restriction to the flow of water. The U. S.



Fueling a Diesel Locomotive at an Intermediate Servicing Station

veyances or to other sources of contamination; (b) post hydrants or elevated faucets with outlets at elevations above the point of discharge of the toilet waste hoppers of conveyances and not exposed to other sources of contamination; and (c) hydrants located not less than six feet from the center line of the nearest track, positively protected against contamination by a suitable housing or hood, and with the point of discharge at sufficient height above the ground or platform so as to be free

drants terminating in downward bends or goosenecks."

Three-inch hydrants should be provided for the delivery of water to Diesel locomotives, two-inch for diners and switching locomotives, and one-inch to one-and-one-quarter-inch for passenger coaches. The size of the hose used should not be less than that of the hydrant and where more than 50 ft. is used it should be one size larger. The kind of hose to be used is optional for ordinary coach service; any good rubber hose is

satisfactory. The hose in use by various railroads for filling locomotive tanks includes heavy rubber hose up to five-ply, reinforced rubber hose and fire hose.

While screw connections are used on some roads, a quick-type coupling of the Anderson or Waterseal type is preferable because of the time saved in making connections. Both hydrants and hose should be inspected at frequent intervals and the necessary repairs made promptly. Suitable storage should be provided for the hose when not in use to protect it from damage and contamination or dirt. It should be drained after use, particularly in cold weather. Hydrants and hose should be carefully handled when in use; more damage is done and more delay results from careless handling than from all other causes combined.

### Water Treatment

Water used on Diesel-electric locomotives, both for cooling engines and for use in car-heating boilers, is usually treated, sometimes by chemicals applied through a feeder on the locomotive, and in other cases by distilling or demineralizing plants. These plants should be given special attention to see that they are operating satisfactorily. Periodic examinations should be made of the

water to see that it is properly treated. Where chemicals are used, the amount on hand should be checked and orders placed for an additional supply in advance of requirements.

### Fueling Facilities

While essentially the same facilities are required for fueling Diesel locomotives at terminals as at intermediate stations, the time employed in fueling is not of the same importance. Terminal fueling stations are usually located near the Diesel servicing shop or enginehouse so that locomotives may be fueled while they are undergoing inspection or repairs. Fueling facilities at intermediate points should be so located that fuel oil and water can be taken at the same time at regular station stops. The fuel oil lines at intermediate stations are usually 3 in. or larger, depending upon their length, and the hose or delivery lines are generally 2½ in. Where long oil discharge lines are required, larger pipe should be used to reduce friction. Short sections of pipe, provided with flexible couplings, are used extensively at terminal fueling stations for the delivery of oil to locomotives. Reinforced synthetic rubber hose is generally used at intermediate stations. It may be provided with a trigger-

type valve and a quarter-turn coupling to engage an appropriate fitting on the locomotive, thereby facilitating the work of servicing.

### Oil Storage Tanks

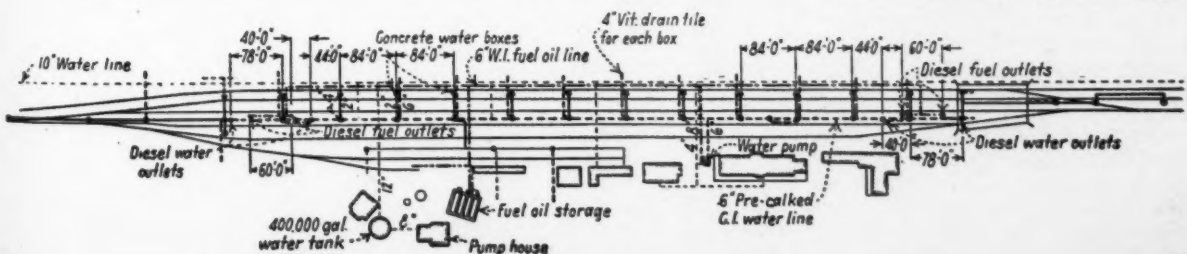
Oil storage tanks should preferably be located above ground to permit ready inspection and painting; where conditions require that they be located under ground, they should be placed in concrete pits to permit inspection and maintenance. All tanks in excess of 50,000-gal. capacity should be surrounded with earth or masonry dikes enclosing an area sufficient to contain a volume of oil equal to the capacity of the tank. Other tanks should also be protected by adequate dikes where wasted oil may endanger adjoining property. All tanks, either above or below ground, should be provided with adequate vents and flame arresters. No combustible material should be allowed within the dikes or within 15 ft. of any oil tank located above ground. Electrical grounds should be maintained on all tanks located above ground.

### Pumps

Pumps for handling fuel oil from tank cars to storage tanks or to locomotives may be of any standard design suitable for handling oil. Electric drives are preferable because of the ease of control. Positive-delivery pumps should have a relief by-pass back to the suction line of the pump. Electric motors should be splash-proof and all connections should be weatherproof. Air pressure is sometimes used to force the oil from the storage tanks, but this practice is not recommended because of the hazards involved. Pumps should have a capacity of not less than 300 gal. per min. at intermediate points. Pumps may have a smaller capacity at terminals, depending upon the requirements. It is important that these pumps be maintained in first-class operating condition at all times to avoid possible delays. It is desirable to provide duplicate pumps as a means of further protection against delays.



Delivering Water to a Streamlined Train at a Terminal Servicing Point



Layout for Fueling and Watering Diesel-Drawn Trains at an Intermediate Point



# What's the ANSWER?

## Railway Crossing Foundations

*What are the advantages of special foundations under railway crossings? The disadvantages? What type of foundation is most satisfactory? Why? What precautions should be observed? Why?*

### Framed Timbers Preferable

By G. J. SLIBECK  
Engineer of Sales, Pettibone Mulliken  
Corporation, Chicago

The foundation of a railway crossing is dependent on five separate items as follows: (1) The height or girder strength of the rail; (2) the timbers under the rail and their position under the crossing; (3) the ballast and the means of its drainage; (4) the subgrade or the initial foundation; and (5) the weather. We can specialize on any one of the first four, or all of them together; but we can do little about the weather, in which most of our troubles lie.

The question of how much of the load the rail will support without undue deflection has a direct bearing on the foundation under it. The A.R.E.A. in its plans for crossings recommends that the height of the rail be not less than six inches. When one stops to consider that a great deal of the girder strength of the crossing is lost at the flange intersections, where the heads of the rails are cut away to form the flangeways, in either open-hearth or manganese crossings, one wonders why some railways still want to use crossings less than six inches high.

About three years ago, some tests were made at McCook, Ill., to determine the stresses set up in a crossing under load. The results of these tests showed conclusively that the weakest parts of a crossing, and where the deflection was greatest, were at the flangeway intersections. This proves that these locations need more support, a fact that is confirmed by the number of cracks occurring at flangeway intersections of solid manganese

crossings. In my opinion, no crossing should be made less than six inches high, and for crossings that are to be placed in heavy-traffic service a height of seven inches or eight inches should be specified. The increase in high-speed, streamlined traffic definitely calls for such heights.

The weakness of the rail structure is reflected, of course, on the timber structure under it. The A.R.E.A. recommendation for tie layouts under crossings of certain angles, is that a tie or timber should be laid longitudinally with the rails bearing the heavier traffic. This is a move in the right direction, but it does not go far enough, because the cross run may have just as much traffic and yet be expected to support on cross-ties as much as the other track is carrying on longitudinal ties. This condition produces, of course, a decided unevenness in the support that is detrimental to the life of the crossing. Where ties are laid diagonally with the crossing, as in the case of small-angle crossings, the poorest foundation support is provided because these ties usually extend under both tracks and whatever conditions develop on one track will be reflected on the other one also.

In my opinion, the answer to this problem would be to go to a framed timber foundation such as the Pennsylvania uses today in the majority of its crossings. This kind of founda-

### To Be Answered in March

1. Should guard rails of the same, lower or greater height than the running rail be used on sharp turnouts? Why? If higher or lower, how much?

2. From the standpoints of economy, ease of maintenance, length of service life and suitability for trucking, what are the relative merits of various materials used for freight-house floors? What other factors are involved?

3. To what extent are ties damaged by pick tamping? What is the effect on their service life? Does this differ between hardwood and softwood ties? What practical means, if any, can be employed to prevent this damage?

4. Is it practicable to drive piles without the use of pile driver leads? If so, how can it be done? Under what circumstances is this desirable? What are its limitations?

5. How can one most economically and effectively widen roadway embankments? If under 5 ft.? If higher? What considerations are involved? What equipment is most suitable?

6. In what ways and to what extent do large locomotive tenders affect water supply and water-supply facilities? What special problems are involved?

7. Should bridge guard rails be equipped with rail braces? Under what conditions? To what extent? What are the advantages? The disadvantages?

8. When modernizing stations, what can be done, in the choice of finishing materials and color schemes for toilet rooms, to minimize vandalism? What other steps can be taken by the building forces to accomplish this purpose?

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

tion gives both tracks longitudinal timbers which extend out far enough to support the connecting-arm joints with the main rails. It not only af-

fords a more uniform and better support for the running rails, but also simplifies the tamping and maintenance of the crossing.

The ballast part of the foundation is difficult to control and causes most of our trouble. I believe that the ballast section of a crossing foundation absorbs at least 75 per cent of the impact, and since this part of the foundation is at the mercy of the weather, we must help it out by using either slag or stone ballast, preferably stone of a size that will drain readily. If the ballast section is too thin, then winter rainfall freezes in it before the moisture can drain off, and heaving occurs. When the water doesn't freeze, a water pocket forms and pumping starts. Ballast which has too much lime content causes cementing, so that neither surface nor underground water can get out.

We have found that we can control the subgrade portion of crossing foundations to some extent at least. It is here that the water pockets form; and we can either install drain pipes deep enough to drain them, or pump in grout to prevent their formation. A regrettable fact is that drain pipes are often installed above the frost line, which in some locations may be from two to six feet below the surface. I believe that grouting is preferable, although to be effective it must be carried a distance of from 25 to 40 ft. on each side of the crossing.

Therefore, my idea of a perfect crossing foundation would be a heavy section of steel on a framed-timber support, 18 to 22 in. of well-drained ballast and a grouted subgrade. If such a crossing were well anchored with anti-creeper on each side, it should give less trouble and cost less to maintain than some present installations.

### Drainage Is Imperative

By L. L. ADAMS

Assistant Chief Engineer, Louisville & Nashville, Louisville, Ky.

Regardless of the type of foundation used under railway crossings, the first requisite is to obtain good drainage. This can usually be done by placing a system of drainage pipe at a depth of about three to four feet below the subgrade of the crossing. If this drainage is correctly installed, a dry and stable subgrade will be assured.

After water has been drained from the subgrade, the maintenance of the crossing is not such a difficult problem; and taking everything into consideration, good, clean ballast at least 12 in. deep under the tie is much

cheaper, and often as satisfactory, as any type of foundation that might be provided. Where the subgrade cannot be drained so as to be sufficiently stable to support the ballast, a concrete slab placed about 12 in. under the ties to act as a support for the crossing will often prove to be advantageous.

Large timbers under a crossing are satisfactory for a while; but it is difficult and expensive to maintain the crossing after the timbers begin to

fail, which sometimes occurs in a short time.

Where maintenance is aggravated by mud and water pumping through the ballast, the use of a mixture of rock and asphalt, or coal tar, as a sub-base will greatly improve the condition. This will cement into an impervious barrier to water, and, at the same time, will be sufficiently elastic to prevent the excessive wear on the crossing which occurs quickly when a rigid foundation is used.

## Personal Injury Investigations

*To what extent should investigations be made of injuries to maintenance-of-way employees? Who should make them? How should the investigations be conducted?*

### Must Be Made At Once

By H. S. ASHLEY

Engineer of Track, Boston & Maine, Boston, Mass.

Every accident resulting in personal injury to any maintenance-of-way employee should be thoroughly investigated by the track supervisor or his assistant as soon as possible after its occurrence. This investigation should be conducted in the field so that the men involved can explain the exact circumstances that existed at the time the injury occurred. The injured employee, whether at work, at home, or in a hospital, should be interviewed as soon as his condition will permit, so that his version of what occurred may be obtained. If the investigation indicates that the injury was caused by a violation of any of the general or safety rules, the supervisor should discuss the rule violation with the foreman and members of his crew, pointing out how the accident might have been prevented.

All the pertinent facts developed during the investigation should be recorded on suitable forms, and copies forwarded by the supervisor to the division engineer, the safety agent, and the claim department for later discussion at staff and foremen's meetings in the interest of accident prevention.

### Should Be Made in Gang

By WAYNE ANDERSON

Section Foreman, Illinois Central, Indianapolis, Ind.

If every maintenance-of-way employee would constantly talk safety, practice safety, always be on the alert, and always endeavor to eliminate hazardous conditions, investigations

of personal injuries would not be necessary. But if this is not done, and an injury does occur, an immediate investigation must be conducted by the track supervisor or division engineer in the gang where the injury occurred, so as to obtain all possible information and to impress upon the remainder of the crew the importance of obeying the safety rules to the end that a recurrence of the injury will be avoided. It is important that all circumstances involved in any injury be carefully examined to determine which might have caused the accident, so that action may be taken to guard against any similar accidents in the future.

### After Each Injury

By SAFETY AGENT

One of the best methods to reduce the number of personal injuries in the maintenance-of-way department is to have a fair and impartial hearing after each injury, with all employees present who were involved. Where the injury is a minor one and does not involve a report to the I.C.C., the investigation can be held best by the immediate supervising officer, such as the roadmaster, master carpenter, signal supervisor, etc. Each person involved in the personal injury, including the foreman, should be furnished a copy of the findings of the investigation; and it is important that each of these reports show that copies are furnished to the division officer in charge. In this manner it is impressed on the minds of everyone, all the way down the line, that all personal injuries are serious.

If the personal injury appears to have involved infraction of the rules, it is necessary to take a formal state-

ment with any representatives and witnesses present who are desired by the person being interrogated. This must be done in order that the investigation will be in proper form in case it is thought advisable to administer discipline. Recommendations for discipline must not be handled lightly, and for that reason the division engineer should conduct the hearings on

all serious personal injuries, or when ever discipline is recommended. Full publicity must be given to any serious infraction of the rules or to any major personal injury, whether rules have been violated or not, in order that all employees of the maintenance-of-way department may know exactly how the injury occurred and what steps were taken to prevent recurrence.

## Metal or Wooden Sash?

*What are the relative merits of metal and wooden sash for railway buildings? Where can each be used to best advantage? Are there substitutes? If so, what?*

### Why Not Plastics?

By MASTER CARPENTER

Neither metal nor wood can be said to be the best material for sash in all railway buildings. The sash in shops, enginehouses, etc., are subject to deterioration from gases as well as from the elements. Treated wooden sash withstand these forces well. However, its metal flashing requires almost as much maintenance as metal sash.

Deterioration in both metal and wooden sash is aggravated by the present necessity of using mechanical means of cleaning windows in most shops and enginehouses. High-pressure streams of water, in the hands of inexperienced or careless window cleaners, may blow out panes of glass, remove the glazing, peel the paint, and otherwise cause damage. Hence it is better to restrict the use of both metal and wooden sash to office or other buildings removed from the proximity of engine exhausts, where either will last for many years.

For those buildings where metal and wooden sash are not satisfactory, it is better to use glass blocks or non-corroding plastics for admitting light. And I see no reason why movable plastic openings should not be provided for ventilation. In any such installation, however, the construction should be substantial enough to withstand washing with solvents.

### Both Have Their Place

By O. G. WILBUR

Assistant to Engineer of Buildings, Baltimore & Ohio, Baltimore, Md.

Generally speaking, metal sash is preferable to wooden sash in better-class construction, except in structures, such as enginehouses, where gases are encountered. In such cases, wood will last longer than metal, since

it is not subject to deterioration from gases. Abusive handling in raising and lowering shortens the life of wooden sash more than it does that of metal. Aside from this wear and tear, metal sash, when correctly set and maintained, will have a longer life.

In small structures that might be

considered of minor importance, wooden sash will serve satisfactorily. Their use is also indicated at locations where the supply is large and more readily obtained than metal sash.

In recent years glass blocks have been used extensively in railway building construction. In many instances, old buildings have been modernized by replacing both metal and wooden sash with glass blocks. Moreover, a large amount of new construction has included glass block windows instead of metal or wooden sash. Such blocks have been used successfully in enginehouses, powerhouses, car-repair shops, machine shops, office buildings and many other types of construction. Window areas in which glass blocks are installed cost less for maintenance because they do not require painting, are easily washed, are hard to break, do not corrode, are fire resistant, last indefinitely, and transmit light effectively. With ventilating units arranged correctly, glass-block construction makes a satisfactory window unit.

## Programs For Maintenance Work

*At what time and in what way should a roadmaster or a supervisor go about formulating his program for maintenance work for next spring and summer? What special factors should be given consideration?*

### They Are Essential

By E. H. BARNHART

Division Engineer, Baltimore & Ohio, Garrett, Ind.

It is essential to have a program for track work, including out-of-face surfacing, crosstie and rail renewals, etc., if constructive maintenance is to be accomplished. There are a number of ways in which this can be developed but, in my opinion, the most successful manner is to have each of the track supervisors submit a program for out-of-face work, exclusive of rail renewals, for his territory about the first of the year. The rail-renewal program is generally handled by the division engineer, based on his allotment of new rail. After the division engineer has carefully inspected the programs submitted by his supervisors, he should call them into a meeting to discuss their programs with them, and decide what shall be done during the ensuing year, carefully considering material and labor conditions.

In order to formulate a comprehensive program, each supervisor must have completed his tie inspection and therefore be familiar with all local conditions in his territory. On the basis of these detailed tie inspec-

tions, the division engineer is able to decide on the locations for out-of-face work.

By having the track supervisors submit their own programs, the division officer will have stimulated a greater interest in the work than if he had made the program himself and sent it to them. Then, too, by going over these programs in an open meeting each supervisor is given a better knowledge of the problems of the other men and a better understanding of the need for more cooperation with each other.

### Work Up With Foremen

By ROADMASTER

During my long experience as a roadmaster, I have found it best to formulate my program for maintenance work with my foremen constantly as I go over the road with them. In working out these programs together, we look forward, not only to next spring or summer, but to work that may cover several working seasons. Usually I try at some time to take my more active and intelligent foremen with me over sections adjoining

theirs so that three or more may discuss and plan the progress of the work that needs to be done.

In this manner, the knowledge of the work that each foreman is to accomplish is well circulated over my district. I have always found that the majority of my foremen will do more work than is programmed for the season. In some cases, it is usual to set the work programmed for the inefficient foreman so that he can accomplish all the work given him; but in some instances it is necessary to give him the help of other foremen who have better conditions than obtain on his section.

The best feature of programming work in this manner is that the roadmaster need never feel uneasy when it is necessary for him to be away from his district for a short period of time, as he knows very well that the work will progress as well in his absence as it does when he is around. This is especially true if he has some of his

younger foremen training to take greater responsibilities whenever the occasion should arise.

Our spring and summer work is so routine that it does not lend itself strictly to programming. Before spring opens up, we endeavor to have all the grubbing and cleaning on our right of way completed, and our drainage facilities well cared for. All the winter's accumulation of debris, cinders, etc., is cleaned from our yards and enginehouse layouts so that, when the working season opens, we can turn to our first responsibility of keeping the main tracks riding well as they come out of the winter.

We first surface and line our tracks and work over our curves before hot weather begins. This includes a careful check on anti-creepers, rail expansion and a drive on tie renewals wherever the track is not scheduled for out-of-face work. By following this procedure we always have a track that rides well, and looks good.

with the increased cost of the longer ties being balanced against the savings in maintenance expenses and the improved riding qualities obtained.

When evaluating the relative merits of crossties of different lengths, a factor of considerable importance is the practice of tamping ties for an equal distance each side of the rails, but leaving an untamped portion in the center of the ties as a safeguard against the track becoming center bound. This being the case, it would appear that the most effective tie length would be the one that offers the greatest length to be tamped, equidistant inside and outside each rail, while permitting an adequate length at the center to remain untamped.

Because of the practice of tamping ties the same distance each way from the rails, any increase in tie length causes the total tamping distance to be enhanced by twice the amount of the increase. In other words, the tamping length for 8½-ft. ties is 12 in. longer, and that for 9-ft. ties is 24 in. greater than the tamping distance for 8-ft. ties. What the longer tie does, in other words, is to permit the tamping length to be increased in a balanced manner without increasing the risk of the track becoming center bound and bringing with it all the disadvantages inherent in such a condition. This increase in tamping length would appear to be particularly desirable in view of the heavier loads now being imposed on the track structure.

There is no denying that there are some disadvantages, initially at least, in going to the longer tie. One of these is the increased cost, but not only would this increase for the 9-ft. tie become less if it were more generally used, but I am convinced that the savings in maintenance expenses and other advantages, that accrue through the use of these longer ties, are more than sufficient to compensate for the price differential. Another disadvantage is the irregular appearance of the tie ends that is created when the longer ties are first introduced. However, this disadvantage will become less and less a factor as the shorter ties are removed.

Recent developments in the stabilization of track do not, in my opinion, have a great deal of bearing on the arguments in favor of a 9-ft. tie. Where the subgrade has been stabilized by an effective method, such as grouting, it is conceivable that the need for going to longer ties would lose some of its urgency at the particular location, but the argument for such ties generally would seem to me to be applicable even where the roadbed is highly stabilized.

## Merits of Longer Ties

*What are the relative merits of crossties, 8, 8½, and 9 ft. long? Do recent developments in the stabilization of track make any difference? If so, in what way?*

### No Question of Merits

By T. A. BLAIR

Assistant Chief Engineer, Atchison, Topeka & Santa Fe System, Chicago

From my point of view, which is based on seven years' experience with 9-ft. ties, there is unquestionably a distinct advantage in the use of such ties compared with the 8-ft. tie, but owing to the many factors involved it is difficult to mention specific points of merit.

The principal purpose behind the use of the longer tie is the increased tamping area obtained, with the corresponding increase in the support for the rail. By using longer ties this objective is accomplished without decreasing the distance between the ties below the amount required for proper tamping, which would be the case if additional ties are inserted to accomplish the same end. Nine-foot ties not only give greater rail support by virtue of the increased tamping area provided, but they also offer greater resistance to lateral thrusts, this being an important factor in high-speed territory.

I do not consider that recent developments in roadbed stabilization have any bearing on the use of longer ties, as it is not their purpose to correct soft spots. However, in certain instances the insertion of longer ties

out-of-face at unstable locations has resulted in a reduction of 50 per cent in maintenance costs, according to those directly responsible for track maintenance in such locations.

Since the adoption of 9-ft. ties on the Santa Fe, ties of this length have been interlaced with the existing 8-ft. ties. For this reason, as might be expected, it is difficult to credit all apparent benefits to the longer ties. However, in locations such as line changes, where the longer ties have been inserted out-of-face, we have obtained better riding track with a noticeable decrease in maintenance.

### Favors the Longer Ties

By DIVISION ENGINEER

Under present-day loads a 9-ft. tie is, in my opinion, superior to the 8½-ft. tie and the latter is much to be preferred to the 8-ft. length. The whole question of the relative merits of ties of different lengths, revolves around the problem of getting a proper support for the rails—a support that will provide a sufficient balanced bearing area to transmit the load to the subgrade while minimizing the possibility of the track becoming center bound. In a sense the problem is one of economics as well as engineering,

## Troubles With Pumps

*What troubles are likely to afflict reciprocating pumps that must handle muddy water? How can they be overcome? Are power requirements affected? How?*

### Lists Principal Troubles

By E. M. GRIME

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

The principal troubles which afflict reciprocating pumps that must handle muddy water include excessive wear of the valves, slight displacement of the valves by reason of small particles of foreign matter lodging between them and their seats, excessive wear (usually designated as scoring) of the pistons or the plungers, and excessive wearing of the packing, the latter trouble being the one that is most frequently seen.

The most obvious step to be taken in overcoming these troubles is first to clarify the water by settlement or filtration, although this may not always be practicable and in many cases is impossible because the water must be taken directly from a turbid stream. Regardless of the type of pump used the presence of any grit whatever in the mud will tend to cause wear of the moving parts.

When pump leakage is first noted the immediate corrective measure is to tighten the packing so that this material, which is softer than the moving pump parts, will adjust itself to fill in the worn or irregular places where liquid is escaping as the parts move. However, the tightening of the packing sufficiently to take up irregularities increases the frictional resistance of the parts and directly adds to the power required. If leaking is allowed to continue the efficiency of the pumping unit is correspondingly lowered and additional power is required to make up the losses.

### Several Are Likely

By G. E. MARTIN

Superintendent of Water Service, Illinois Central System, Chicago

Reciprocating pumps that handle muddy water are likely to be afflicted by several troubles. The most serious of these is the resulting excessive wear of piston rods, pistons, cylinders, packings, water valves and water-valve stems. The efficiency of pumps is adversely affected by the wear of the various parts and also as a result of the lodging of sand particles on the faces of water valves. Also, some settlement of material in the pipe lines

is likely to occur when muddy water is pumped, thereby restricting the free flow of water and causing the pumping head to be increased.

When practicable to do so, it is advisable to minimize the amount of suspended matter in the water being pumped by the construction of intake sumps or quiet pools where the suspended material can settle out. As far as the pumps themselves are concerned, the types of material used in the manufacture of the various parts that are subjected to the excessive wear should be those that are best suited to resist wear, giving proper consideration to the first cost to the end that replacement costs will not be excessive. For example, steel and

brass are available for most pump piston rods. Steel will not only have better resistance to the excessive wear involved when muddy water is handled, but its first cost is less. For the same reason, cast iron water cylinders should be used instead of brass.

The power requirements are affected in proportion to changes in the efficiency of the pump and by any increase in the pumping head that might occur as a result of settlement in the pipe line. From the standpoint of pump efficiency, it has been observed that medium soft rubber water valves are best suited when cold and muddy water is pumped. The slippage is less with this type of material than with other types, and consequently the pump efficiency is higher. Suitable outlets should be provided in pipe lines to permit the frequent flushing of any accumulation of mud that might cause the pumping head to be increased. Also, the worn pump parts should be replaced as needed to keep the pump efficiency fairly high.

## Headwalls For Pipe Culverts

*Should pipe culverts be equipped with headwalls? Why? What are the advantages? The disadvantages?*

### Not Often Needed

By S. F. GREAR

Assistant Engineer of Bridges, Illinois Central, Chicago

In my opinion, very few pipe culverts need to be equipped with headwalls. Instead, culverts should be long enough to reach the toe of each slope to avoid the necessity of constructing headwalls.

In earlier days of railroad construction, culverts consisted of stone arches or stone boxes, or were built of iron pipe or brick. They were generally built shorter than the width of the fill and headwalls were added, which were made of either brick or stone. The widening of fills and deterioration of the construction materials have caused much trouble with these old headwalls.

Some people believe that a well-designed headwall tends to hold the pipe in place and keep it from separating at the joints; however, such cases of separation are so few that the added cost of a headwall is unwarranted. Occasionally, we have found places where the right of way is not wide enough to permit a full-length pipe to be installed, in which event either a headwall or additional property is required. We have found that it is cheaper, generally, to buy the property.

We had occasion recently to place a pipe culvert immediately downstream from a small earth dam, and headwalls were built to prevent possible cutting along the outside of the pipe in case the dam should break. Ordinarily, however, pipe culverts constructed to the correct size and length should not require headwalls.

### Cost Is a Disadvantage

By C. A. WHIPPLE

District Engineer, Chesapeake & Ohio, Columbus, Ohio

The decision as to when to equip a pipe culvert with headwalls depends on many factors, such as whether its location is under a railway fill or at a highway grade crossing; whether the right of way is wide or narrow; whether it is located in a populated area or in the country, etc.

If the culvert is under a highway at a grade crossing, headwalls may be necessary to maintain line and grade. If the right of way is narrow, headwalls will be necessary to retain the fill. If the culvert is located in a populated area, headwalls will often be installed in order to make a good appearance. Whenever headwalls are built, the line of the culvert is main-

tained better and the discharging capacity of the culvert is assured.

The major disadvantage of headwalls is the additional cost required to build a wall sufficiently large to retain the fill during future years of maintenance. I believe that, in general, culverts located in sparsely populated areas, which are long enough in relation to the embankment, do not need headwalls and being without them lend themselves to extension or change without difficulty.

### Seldom Needed

By L. G. BYRD

Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Where pipe culverts are installed instead of concrete boxes the reasons are the low cost of installation and the fact that they can be installed relatively quickly. We have installed many lineal feet of pipe culverts of various diameters and in very few cases has it been necessary to equip them with headwalls. In a few cases we have constructed headwalls at locations where the track is parallel with a bluff or hill on one side, and in other cases where it was found necessary to construct a spillway to eliminate washing of the embankment.

In the low lands of bottomis where pipes are installed for drainage or to equalize water we have not found it necessary to construct headwalls. It is true that when headwalls are constructed the culvert pipe is shortened a few feet, but this is at the expense of adding considerably to the cost. Galvanized pipe can be furnished with the top cut to the slope of the embankment, and when this is done no part of the pipe is exposed beyond the embankment. In other words, there is seldom any advantage to be realized by constructing headwalls on pipe culverts, while a disadvantage is the increased cost that is involved when this is done.

### Depends on Conditions

By TRACK SUPERVISOR

The question of whether pipe culverts should be equipped with headwalls is one to be decided entirely on the basis of the conditions prevailing at the particular location. However, it should be borne in mind that such headwalls comprise a cost item of considerable importance, and it is obviously unwise to incur the expense of constructing them unless a purpose is to be served that cannot be achieved by a less costly expedient.

Conditions are frequently such at the locations of pipe culverts that headwalls or related appurtenances must be provided to prevent damage to the embankment or to the culvert itself. It often happens, for instance, that the upstream faces of embankments at culvert locations would be subject to considerable scour unless protected by headwalls, especially if the stream approach is at an angle with the embankment. Obviously, if the flow of water is parallel with the track, requiring that it be diverted at right angles on entering the culvert, the inlet end of the culvert must usually not only have headwalls but also a suitable arrangement for deflecting

the water, possibly including a paved flow line to prevent scour. Headwalls at the upstream ends of culverts are also sometimes desirable to prevent seepage into the fill.

Where scour is likely to occur at the outlet of a culvert it may be necessary to provide a headwall and curtain wall or spillway, especially if the volume of flow is excessive. There are other situations, too, that may require the use of headwalls, such as when the right of way is of limited width, or where some means is necessary to prevent movement of the embankment that may tend to pull apart, or otherwise displace the culvert sections where this is a consideration.

## Anchor Bolts in Concrete

*Should anchor bolts for bridge seats, or building columns or other anchorage of steel members to concrete, be installed by template when the concrete is being placed, or should holes be drilled to receive them? Why?*

### Depends on Structure

By L. G. BYRD

Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

My experience with work of this kind is that, where beam spans or girders are involved, it is more economical to drill holes in the concrete for anchor bolts after the steel has been set in position. When the work under way involves the replacing of these and other members of the structure, as much speed as possible is desirable in order to minimize delays to traffic. This end can be served by setting the members on the masonry plates and placing the anchor bolts as soon thereafter as possible for it will be safe for traffic to move over the structure for a short time while the anchor bolts are being inserted. Using this procedure, the members can be accurately located and the holes then drilled for the anchor bolts, which need to extend only 10 to 12 in. into the concrete.

On the other hand, anchor bolts for building columns and coal chutes should be installed by templates, as long bolts are required for such structures in order to anchor them adequately against the uplift forces that are brought into play during heavy winds. Such anchors must be placed accurately and to a sufficient depth to give at least the strength of  $1\frac{1}{2}$  the uplift. Another reason for using template for columns is that after such members are installed they cannot be shifted as can beam spans and girders for bridges.

Bolts for anchoring truss spans

with a high elevation, especially if they are of the cantilever design, should likewise be placed by template as such structures are also subject to uplift forces induced either by the wind or by the action of the structures themselves.

### Is Strong For Template

By C. E. JACOBSON

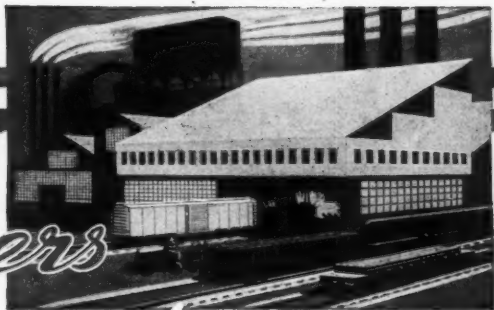
Engineer of Bridges, Atlanta & West Point, Atlanta, Ga.

By all means, anchor bolts for bridge seats or for other anchorages to concrete should be installed by templates when the concrete is being placed. This is by far the simplest and surest method of obtaining a full and secure anchorage in the concrete mass. When templates are used, which have been accurately located with considerable care, the final operation of placing the bed plate will be greatly speeded.

The necessity of setting up equipment for drilling is a time-absorbing procedure, and the additional time consumed in drilling a core for a  $1\frac{1}{4}$ -in. bolt to a depth of 18 in., to use an example, is considerable. Furthermore, should the bridge seat or column base be heavily reinforced, which is not unusual, the probability of encountering steel when drilling is very high. Those who have had experience in drilling holes in old reinforced concrete structures will agree that it is most aggravating to encounter reinforcing steel, for this usually happens at a time when speed is of the essence.

# PRODUCTS

## *of Manufacturers*

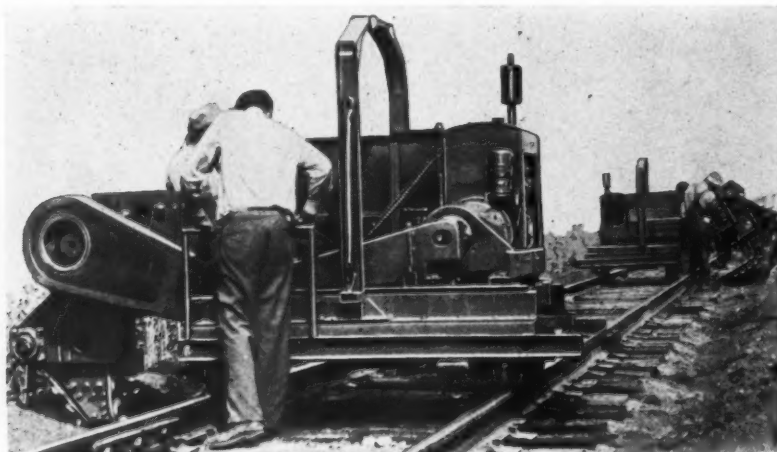


### Nordberg Cribex

THE Nordberg Cribex, an on-track machine for excavating ballast and dirt from the tie cribs and depositing this material beyond the ends of the ties, is now offered by the Nordberg Manufacturing Company, Milwaukee

four-wheel transverse carriage which in turn supports the power unit and the digging and excavating mechanism. The latter unit consists of a pivoted digger boom equipped with an endless roller chain. Digger flights are mounted on the chain for removing ballast from the cribs. The action

The manufacturer recommends that a pair of the units be used in tandem, one machine removing the ballast from one side of the track while the second machine works on the other side. The Cribex may also be used in tie-renewal work, removing the ballast from one side of each tie that is to come out of the track. A further application of this unit is in lowering track on bridge or highway-crossing approaches. In this application, the machine excavates the cribs to a depth of 13 in. below the tops of the ties, after which the ties are shifted to the deeply excavated cribs, and the track lowered to the new grade.



A Pair of Nordberg Cribex Machines Working in Tandem. The Machine in the Fore-ground Is Shown With the Digger Boom Fully Under the Rail, While the Boom of the Second Machine, Removing the Ballast from the Other Side of the Track, Has Only Partly Penetrated the Crib

7, Wis. This unit embodies a digging and excavating mechanism, which in operation enters the crib at the ends of the ties and extends under the rail as far as the center of the track, removing the ballast and leaving a uniformly graded floor slightly below the tie bottoms, with the edges sloping upward at an angle of 45 deg. towards the ties. The Cribex requires an operator and a helper, and is designed to excavate about 100 cribs per hour, depending upon the nature of the ballast and the ability of the operator. According to the manufacturer, mud and dirty ballast which often stick to the ties where hand cribbing is done, are removed by the Cribex without damage to the ties.

The Cribex is mounted on a four-wheel truck for movement along the track. The truck frame supports a

of the digging mechanism is such that the endless chain removes the ballast as the boom penetrates into the crib.

All movements of the digger boom and the transverse carriage—lowering the boom to enter the crib, the travel to the center of the track, the reverse travel after the crib is excavated, and raising the boom for travel to the next crib—are governed by hydraulic controls requiring little effort on the part of the operator. Power is supplied by a 20-hp., 4-cylinder, gasoline engine which drives the endless-chain digging mechanism and operates a high-pressure pump for the hydraulic controls. A set-off device with a hydraulic lift is provided for removing the Cribex from the track when the unit is working under traffic. It is said that the machine can be moved into the clear in less than 90 sec.

### Tie Plate Assembly

THE H. L. Rushing Company, 723 Commercial Street, Nashville 3, Tenn., has developed a new tie plate



A Non-Cutting Tie Plate Installed With One of the Drive-Spike Buck Plates

and a companion Buck plate, which, together, are said to hold the rail to gage, resisting lateral movement and

consequent plate cutting of the tie fibers. This assembly is intended primarily for use on main-line curves and turnouts and at similar locations

types, are also fashioned with a vertical chaffing face and are applied outside the tie plate, with the chaffing face abutting that of the tie plate.



An Application of the Screw-Spike Buck Plates With Existing Switch Plates at a Main Track Interlocked Turnout

on more important yard tracks, but can be used elsewhere where conditions require.

The new tie plate, which is punched to receive cut spikes for holding the rails, is of a special design in which the inner and outer ends are bent upward at an angle of 90 deg., thereby presenting curved edges which, contrasting with the sharp edges of conventional tie plates, are said to eliminate a major cause of plate cutting of the ties. At the same time the turned-up ends of the plate present vertical chaffing faces for transmitting lateral thrust to the Buck plate.



One of the Drive-Spike Buck Plates. The Spike Holes Are Tapered and a Raised Striking Block, Beveled to Fit the Under Side of the Spike Head, Is Provided at Each of the Spike Holes

There are three sizes of the new plate. A small plate is designed for use with 90-lb. rail, a larger size accommodates 100-lb., 110-lb. and 112-lb. rail, while a third size is designed for the 131-lb. section. The plates are 7 $\frac{3}{4}$  in. wide, and 11 in., 12 in. and 13 in. long, respectively, and are of the flat-bottom design. The rail seat of each size is beveled and has a 1 in 40 cant.

The Buck plates, which are of two

These plates may also be applied against existing switch and frog plates to resist lateral movement and thus increase the tie life at these points. One of the Buck-plate types is designed for use with two drive (cut) spikes, while the other utilizes two 15/16-in. screw spikes to hold the plate and to resist lateral thrust.

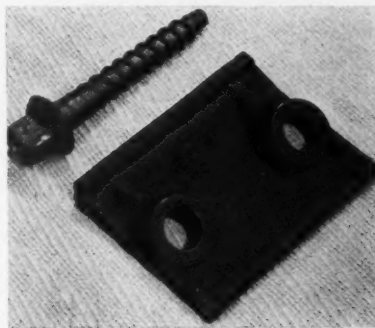
The drive-spike Buck plate is the smaller of the two and is made of grey iron. The spike holes in this plate are tapered slightly to fit the shank of the spikes, and a raised striking-block, canted 4 to 1 so as to fit the under side of the spike head, is provided along the inner side of each hole. These plates are recommended by the manufacturer for use with existing frog and switch plates on secondary tracks and in yards, or with the non-cutting tie plate in similar locations.

The screw-spike Buck plate is also made of grey iron and is of a special design in which the spikes enter the tie, toward the center of the track, at an angle of 30 deg. from the vertical, a feature that is said to offer advantages in that lateral thrust against the plate is resisted by the screw spikes in tension. The under side of the plate is recessed  $\frac{1}{8}$  in. about each of the spike holes to accommodate any bulge of the wood about the screws, which otherwise might tend to lift the plate from the tie.

The 15/16-in. screw spikes offered for use with the Buck plates are said to be an improved GEO design and are intended to be wrenched into an 11/16-in. hole. A patented tell-tale on the spike head enables detection if the spike is maul driven rather than applied with a wrench.

The screw-spike Buck plate is for main-track and heavy-duty yard application, particularly on sharp curves and at switches, in conjunction with the non-cutting tie plate, but can also be used at turnouts with conventional plates.

These units have been tested for some time on a number of roads and the results are said to have proved highly satisfactory, even when installed on ties that were already severely damaged by checking or by excessive wear in the tie-plate area. It is said that their ability to hold the track to gage is due largely to the



The Screw-Spike Buck Plate and One of the Spikes. Note the "Tell-Tale" on the Spike Head, the Purpose of Which Is to Enable Detection of Maul Driving

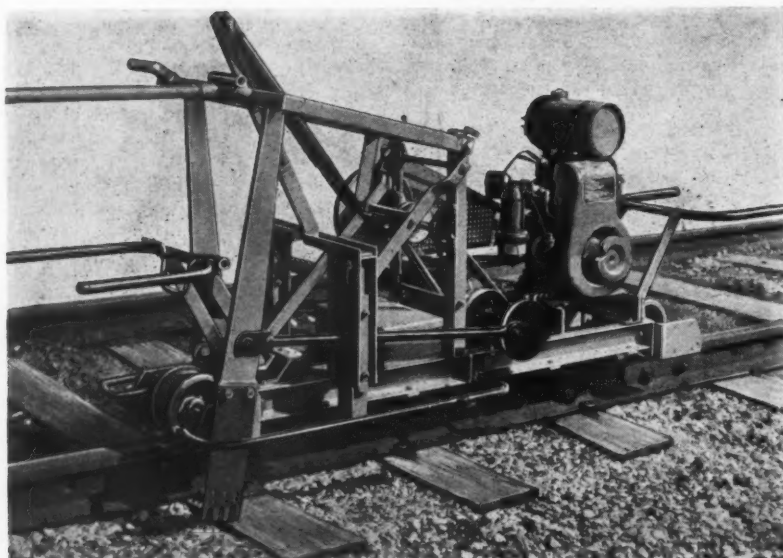
fact that the Buck-plate spikes are not affected by the wave action of the rail and, therefore, do not become loosened.

## Tie Cutter and Scorer

THE tie-cutting machine manufactured by the Woolery Machine Company, Minneapolis 15, Minn., has recently been improved to enable this unit to be used also for scoring ties in advance of rail-laying or tie-plate-renewal work. The principal change has been the addition of a new reciprocating arm and saw-blade assembly, operating outside of the rail, together with adjustable stops for controlling the depth of the scoring cut and the spacing between the new saw blade and another blade, operating inside the rail, at the desired width for scoring. Now known as the Woolery Combination Tie Cutter and Tie Scoring Machine, this unit, it is said, will score ties at the average rate of 10 sec. per tie.

When it is desired to use this machine in cutting ties for removal from the track, the blade operating outside of the rail is removed. The inside blade is then used to cut through the tie after which the machine is moved to the next tie to be removed. It is said that the average time required to cut through a tie is 35 sec.

After a tie has been cut into three pieces by a cut immediately inside each rail, the end sections are pried out with a bar, after which the center



The Woolery Combination Tie Cutter and Tie Scoring Machine

section is lifted out from between the rails. In this manner, it is said, all cribbing and much of the digging is eliminated and the old tie bed is not disturbed.

each side of the base. To apply the stabilizer it is placed under the rail with the base resting in the ballast and with the ends of the legs secured to the base of the rail by means of double-bolted rail clips.

## Track Stabilizer

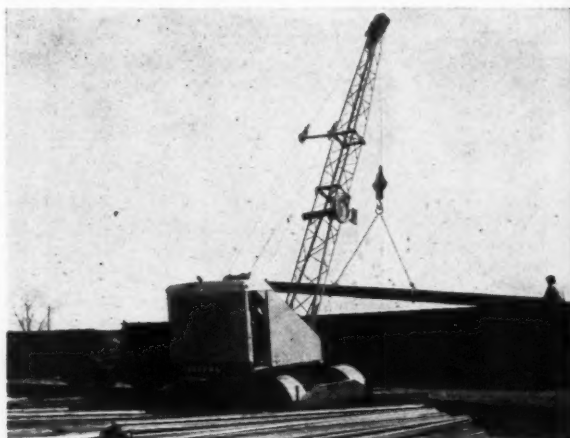
THE Morrison Railway Supply Corporation, Buffalo 12, N. Y., has developed a track appliance, known as the Morrison Track Stabilizer, the



One of the Morrison Track Stabilizers in Position in the Track

use of which is said to result in greatly reduced track maintenance costs, especially at the joints. This appliance is constructed of 3-in. by ½-in. steel strap material shaped roughly in the form of a "U" with a flat base and with extension shoes projecting from

One of The General Model 105, Mobile Cranes



Advantages claimed for the stabilizers are that they serve as automatic tie tampers; that they help to preserve the established super-elevation on curves and to hold the track in line; that they provide additional bearing surface under the rail; and that they eliminate "pumping" of the track, especially at the joints.

To the present time test installations of the stabilizer have been confined to the joint areas, with the use of four at each joint being recommended. The plan of application is to place a stabilizer against each of the first two ties in each direction from the joint, applying them to bear against the sides of the ties away from

the joint. During such tests the ballast has frequently been removed from the cribs containing the stabilizers in order that their action could be observed under traffic. These observations are reported to show that the stabilizers are surprisingly effective in maintaining a solid area of ballast under the ties and in preventing pumping at the joints where they are used. At locations where joint ties normally started pumping within two or three months after the track was raised, the joints at which the test stabilizers were installed were said to show no indication of pumping after a year.

## Mobile Crane

DESIGNATED as Model 105, a new self-propelled mobile crane has been introduced by the General Excavator Company, Marion, Ohio. Mounted on four pneumatic-tired wheels, the new crane is said to be fully mobile, being capable of road speeds up to 20 m.p.h. and is claimed to possess ample power to enable it to move to the point of work without requiring spe-

cial roadbed or tracks. An air-booster steering mechanism facilitates the maneuvering of the unit.

The Model 105 may be easily converted for pile-driver, clamshell, hook or magnet operation, as desired, and is said to be capable of handling a wide variety of tasks in terminals and yards as well as off-track work along the right of way.

**CROSSTIE PURCHASES AND STOCKS**—Crosstie purchases during September continued at a fast clip and aggregated \$8,044,000, the highest monthly purchase of this material since August, 1943. Crossties in stock on September 1 were 6 per cent less than on Aug. 1.

## Changes in Railway Personnel

### General

**C. N. Billings**, division engineer on the Southern Pacific, at Ennis, Tex., has been appointed assistant superintendent, with headquarters at Austin, Tex., and Ennis.

**W. J. Bergen**, engineering assistant to the president of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has retired after 45 years of service.

**L. B. Allen**, vice-president of the Chesapeake & Ohio, and an engineer by training and experience, with headquarters at Cleveland, Ohio, has retired after 47 years of service.

**Jack Small**, assistant engineer, bridge department, on the Louisville & Nashville, at Louisville, Ky., has been appointed assistant trainmaster at Birmingham, Ala. **Alfred James, Jr.**, assistant engineer, bridge department, at Louisville, has been appointed assistant trainmaster at Latonia, Ky.

**C. J. Geyer**, general manager of the Chesapeake & Ohio, with headquarters at Richmond, Va., and formerly engineer maintenance of way of this road, has been advanced to assistant vice-president, with the same headquarters.

**Armstrong Chinn**, chief executive officer of the Alton since October 4, 1945, and formerly chief engineer of this road, has been elected president of the Terminal Railroad Association of St. Louis, with headquarters at St. Louis, Mo., succeeding **Philip J. Watson**, whose death on November 1 was reported in the December issue. Mr. Chinn was born at Dallas, Tex., on September 26, 1894, and received his higher education at the Virginia Polytechnic Institute, from which he received his degree of B. S. C. E. in 1915, and the degree of C. E. in 1916. In June, 1916, he entered the service of the Chicago, Burlington & Quincy as an instrumentman at St. Louis, Mo. From January, 1918, to June, 1919, he served as a field artillery officer in the United States Army. He returned to the Burlington in July, 1919, and served as an instrumentman at various locations until June, 1922, when he was promoted to assistant engineer at Aurora, Ill. In August, 1923, Mr. Chinn was advanced to division engineer and roadmaster on the Quincy, Omaha & Kansas City (part of the Burlington System), at Kansas City, Mo. Two years later he became assistant roadmaster on the Burlington, at Kansas City, and in August, 1926, he was promoted to assistant district engineer maintenance of way, at Alliance, Neb. From April, 1927, until September of that year, he was district engineer maintenance at Alliance. On the latter date he was transferred to Lincoln, Neb., and at the same time he was also made supervisor of work equipment. Mr. Chinn entered the service of the Alton in December, 1929, as chief engineer, and remained in that capacity until March, 1943, when he was promoted to general man-

ager. On October 4, 1945, he became chief executive officer of the road. Mr. Chinn is senior vice-president of the American Railway Engineering Association; and is a past president of the Roadmasters



Armstrong Chinn

and Maintenance of Way Association, the American Railway Bridge & Building Association, and the Maintenance of Way Club of Chicago.

### Engineering

**Samuel L. McClanahan**, division engineer on the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., has retired.

**C. P. Howard** has been appointed chief engineer of the Oneida & Western, with headquarters at Jewell Ridge, Va.

**C. F. Thomas** has been appointed secretary and chief engineer of the Spokane, Portland & Seattle, with headquarters at Portland, Ore., succeeding **A. J. Witchel**, who has retired following 41 years of service.

**A. T. Hawk**, engineering architect of the Chicago, Rock Island & Pacific, with headquarters at Chicago, retired on December 1 after 42 years of service with the Rock Island and 4 with the Chicago, Burlington & Quincy.

**J. C. Jacobsen**, chief draftsman on the Chicago, Rock Island & Pacific, at Chicago, has been appointed office engineer, with the same headquarters, succeeding **S. T. Corey**, whose retirement was reported in the November issue.

**Alan K. Frost**, assistant engineer on the Erie, at Cleveland, Ohio, has been promoted to assistant to the chief engineer maintenance of way, with headquarters as before at Cleveland, to succeed **W. H. Brameld**, whose retirement was reported in the December issue.

**J. E. Weatherly**, assistant division engineer on the Southern Pacific, Texas and Louisiana Lines, at Houston, Tex., has been promoted to division engineer there,

succeeding **A. P. Reese**, who has been transferred to Ennis, Tex. Mr. Reese succeeds **C. N. Billings**, whose promotion to assistant superintendent, with headquarters at Austin, Tex., and Ennis, is reported elsewhere in these columns.

**W. Y. Ware**, formerly assistant engineer in the office of the chief engineer of the Atchison, Topeka & Santa Fe, at Galveston, Tex., has been promoted to division engineer, with headquarters at Temple, Tex., succeeding **Z. A. Green**, who has retired.

**W. R. Baker**, roadmaster on the Atchison, Topeka & Santa Fe, has been appointed division engineer, with headquarters as before at Las Vegas, N.M., succeeding **H. E. Wilson**, whose appointment as district engineer of the Los Angeles, Valley and Terminal divisions, with headquarters at Los Angeles, Cal., was reported in the November issue.

**E. Nicholson**, assistant engineer on the Canadian National, with headquarters at Toronto, Ont., has retired. Mr. Nicholson was born in 1879 at Manchester, England. He entered railroad service in 1916 as a structural draftsman on the Grand Trunk, at Montreal, Que. He became masonry draftsman and reinforced concrete designer in 1917, and assistant engineer in 1918. Later he was transferred to the bridge department, at Toronto, and in 1925, he joined the office of the district engineer.

**J. D. Newman** has been appointed assistant cost engineer on the Chesapeake & Ohio, with headquarters at Peru, Ind., succeeding **P. E. Chapin**, whose promotion to supervisor of track, with headquarters at Peru, was reported in the November issue. **J. O. Sale** has been appointed assistant cost engineer, Piedmont and Rivanna subdivisions, with headquarters at Richmond, Va., succeeding **R. H. Abbott**, who has been appointed assistant cost engineer on the Peninsula and Newport News and Norfolk Terminal subdivisions, with the same headquarters.

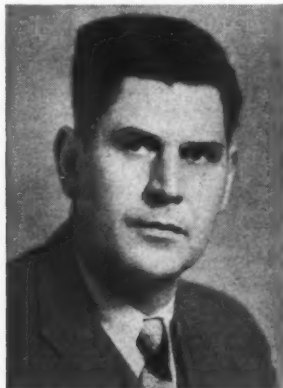
**H. M. Hoffmeister**, assistant engineer of water service on the Missouri Pacific, at Houston, Tex., has been promoted to assistant engineer of tests, with headquarters at St. Louis, Mo., succeeding **E. C. Meinholts**, who has been appointed engineer of tests, at St. Louis, succeeding **J. R. Jackson**, who has been granted a leave of absence to serve with the mechanical division of the Association of American Railroads. **Robert D. Yeargain**, district water chemist, at Little Rock, Ark., has been promoted to assistant engineer of water service, with headquarters at Houston, where he succeeds Mr. Hoffmeister.

**E. R. Murphy**, assistant division engineer on the Electric division of the New York Central, at New York, has been promoted to division engineer on the St. Lawrence, Adirondack and Ottawa divisions, with headquarters at Watertown, N.Y. **J. E. Spangler**, supervisor of track on the Syracuse division, with headquarters at Lyons, N.Y., has been appointed assistant division engineer on the Electric division, at New York, to succeed Mr. Murphy. **A. Bell, Jr.**, assistant supervisor of track at Oneida, N.Y., has been ap-

pointed assistant engineer at New York, to succeed **J. R. Watt, Jr.**, whose appointment to supervisor of track at Corning, N.Y., is reported elsewhere in these columns.

**H. R. Peterson**, principal assistant engineer of the Northern Pacific, at St. Paul, Minn., has been promoted to assistant chief engineer, with the same headquarters. **G. L. Smith**, engineer of track, has been promoted to system engineer of track, with headquarters as before at St. Paul. **J. E. Hoving**, office engineer at St. Paul, has been promoted to principal assistant engineer, with the same headquarters, succeeding Mr. Peterson. **D. H. Shoemaker**, assistant engineer, who has just completed supervision of a line change with headquarters at New Salem, N.D., succeeds Mr. Hoving as office engineer at St. Paul.

**H. S. Purdom**, whose appointment as district engineer on the Chesapeake & Ohio, with headquarters at Huntington, W. Va., was reported in the December issue, was born at Talesboro, Ky., on



H. S. Purdom

October 19, 1898, and received his higher education at the University of Kentucky. He entered railroad service with the C. & O. in May, 1917, as rodman on construction, becoming instrumentman in November, 1917. Mr. Purdom was construction foreman for the Dravo Contracting Company from August 20, 1920, to December 23, 1923, returning to the C. & O. on the latter date as masonry inspector in the engineering department. He was appointed resident engineer on July 26, 1928, instrumentman on April 14, 1932, assistant engineer on June 1, 1936, and assistant cost engineer on January 16, 1937. Mr. Purdom became yardmaster on June 6, 1938, and was appointed assistant trainmaster on June 24, 1940, becoming trainmaster on July 1, 1942. On February 22, 1944, he was appointed inspector in the engineering department, becoming resident engineer on July 24, 1944, which position he held until his recent appointment as district engineer.

**Frederick H. Boulton**, assistant supervisor of bridges and buildings on the Louisville & Nashville, at Louisville, Ky., has been appointed assistant engineer, bridge department, with the same headquarters. **Claude Johnston**, draftsman in

the engineering department at Louisville, has been appointed assistant engineer on the Eastern Kentucky division, with headquarters at Ravenna, Ky., succeeding **R. B. Lindsey**, appointed assistant engineer, bridge department, at Louisville. Subsequently, Mr. Lindsey was appointed resident engineer in charge of reconstruction of the road's bridge at Gautier, Miss. **R. E. McLaughlin**, draftsman in the engineering department at Louisville, has been appointed assistant engineer, with the same headquarters, succeeding **Marow Cox**, who has been appointed assistant engineer, bridge department, at Louisville.

### Track

**W. K. Putney**, supervisor of track on the Piedmont subdivision of the Chesapeake & Ohio, at Richmond, Va., has been transferred to Charlottesville, Va.

**Henry W. Smith**, roadmaster on the Pocahontas division of the Norfolk & Western, with headquarters at Fort Gay, W. Va., has retired.

**James E. Crawford**, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has retired.

**H. F. Lambert** has been appointed acting roadmaster on the Atlantic Coast Line, with headquarters at Thomasville, Ga., succeeding **J. Y. Chambers**, assigned to other duties.

**J. D. Bogard**, extra gang foreman on the Illinois division of the Illinois Central, has been appointed supervisor of track, with headquarters at Bloomington, Ind., succeeding **E. F. Snyder**, promoted.

**Melvin B. Mowrer**, track master on the Alton at Bloomington, Ill., has been appointed supervisor of track at Joliet, Ill., succeeding **F. L. McMillan**, who has retired.

**John A. Shuler**, supervisor of track on the Atchison, Topeka & Santa Fe, has been appointed roadmaster on the Northern division, with headquarters at Ft. Worth, Tex., succeeding **A. T. Darnell**, who has retired. **L. V. Lee** has been appointed supervisor of track to succeed Mr. Shuler.

**L. Stott** has been appointed roadmaster on the Canadian National, with headquarters at Smith's Falls, Ont., succeeding **A. Martin**, who has been transferred to Peterboro, Ont., where he succeeds **J. A. Brennan**, who in turn has been transferred to Belleville, Ont., to succeed **F. B. Griffin**, retired.

**James S. Walpole**, who was formerly track supervisor on the Chicago, Rock Island & Pacific, at Peoria, Ill., and who has been on temporary leave of absence on account of illness, has returned as acting roadmaster at Enid, Okla., where he succeeds **C. M. Webb**, who has been granted a leave of absence on account of illness. **D. W. Bickett**, who has been on leave of absence on account of illness, has returned to his former position as roadmaster at St. Joseph, Mo. **R. P. Scott**, who has been acting roadmaster at St. Joseph, has been appointed roadmaster at El

Dorado, Ark. **J. K. James**, roadmaster at Des Moines, Iowa, has been transferred to Washington, Iowa, replacing **W. F. March**, who in turn has been transferred to Des Moines, where he succeeds Mr. James.

**A. H. Tolbert** has been appointed roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Las Vegas, N. M., succeeding **W. R. Baker**, whose promotion to division engineer, with headquarters at Las Vegas, is reported elsewhere in these columns.

**D. C. Hastings** has been appointed supervisor of track of the Potomac yard of the Richmond, Fredericksburg & Potomac, with headquarters at Alexandria, Va., succeeding **Stuart Shumate**, who has been transferred to Fredericksburg, Va. Mr. Hastings was formerly supervisor of track on the Pennsylvania, at Buffalo, N.Y.

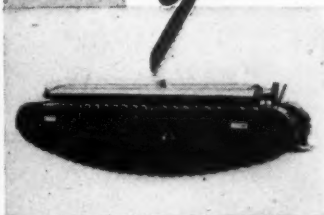
**M. C. Fleming**, supervisor of track on the Pennsylvania Railroad, at Lockhaven, Pa., has been transferred to Derry to replace **Frank Aikman**, resigned. **H. M. Curtiss**, acting supervisor of track on the Fort Wayne division, with headquarters at Warsaw, Ind., has been appointed supervisor of track on the Buffalo division, at Buffalo, N.Y., to succeed **D. C. Hastings**, also resigned. **D. E. Pergrin**, assistant supervisor of track on the Eastern division, at Freedom, Pa., has been promoted to supervisor of track, with headquarters at Lockhaven, to succeed Mr. Fleming. **D. A. Sutherland**, assistant supervisor of track on the Conemaugh division, at Aspinwall, Pa., has been transferred to Freedom, succeeding Mr. Pergrin, and **R. F. Hall, Jr.**, assistant on the engineer corps on the Panhandle division, has been promoted to assistant supervisor of track, to succeed Mr. Sutherland at Aspinwall.

**E. M. Skelton**, supervisor of track on Subdivision 27, Pennsylvania division, New York Central, at Clearfield, Pa., has been transferred to Subdivision 29, Eastern division, with headquarters at Brewster, N.Y., to succeed **F. H. Egan**. Mr. Egan has been transferred to Subdivision 2, Electric division, with headquarters at Harmon, N.Y., where he replaces **O. C. Anderson**, who in turn succeeds Mr. Skelton on the Pennsylvania division at Clearfield. **E. T. Delaney**, supervisor of track on Subdivision 24, Pennsylvania division, at Corning, N.Y., has been transferred to Subdivision 10, Syracuse division, with headquarters at Lyons, N.Y., succeeding **J. E. Spangler**, whose promotion to assistant division engineer on the Electric division at New York, is reported elsewhere in these columns. **J. R. Watt, Jr.**, assistant engineer at New York, has been promoted to supervisor of track, with headquarters at Corning, to succeed Mr. Delaney. **W. Baerthlein**, assistant supervisor of track on Subdivision 30, Buffalo division, with headquarters at Rochester, N.Y., has been transferred to Subdivision 8, Mohawk division, at Oneida, N.Y., to replace **A. Bell, Jr.**, whose appointment to assistant engineer, with headquarters at New York, is

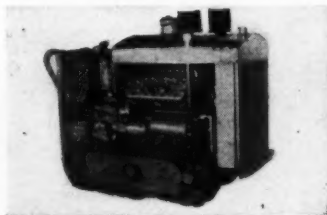
(Continued on page 74)

Put thought as well as money  
into your next air compressor

get a **SCHRAMM**



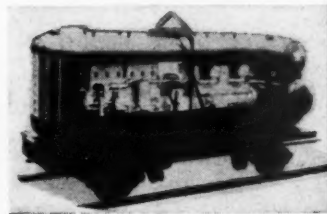
Off-track crawler, gasoline or Diesel. Operates up to 12 tampers.



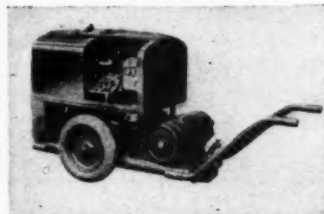
Model 60 Fordair off-track crawler for 4 tampers.



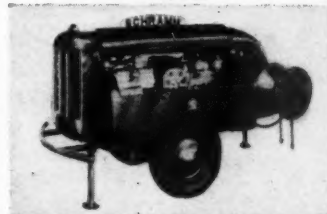
Model 60 self-propelled rail car.



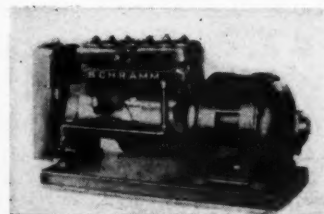
Railcar mounted, 105 to 420 cubic feet actual air capacity.



Model 60 Tamper for 4 tampers.



Two-wheel trailer, 60 to 105 cubic feet actual air capacity.



Stationary models—electric, gasoline, Diesel, and belt-driven.



For greatest efficiency use Schramm tampers and other air tools.

IT stands to reason that you can get a better compressor from America's leading manufacturer of compressors exclusively. For one thing, Schramm is compressor-wise; we have been building them for 39 years. Many features such as clutches and electric starting which are now standard on all good compressors were pioneered by Schramm. Other improvements—positive cam-operated intake valves for maximum air delivery, to mention only one—are found on Schramm compressors alone.

You have certain jobs for compressors to do; Schramm has the models and sizes to do them. A few are shown here. Others to fill any railroad need—maintenance, signaling, switching or shop—are described in the complete Schramm catalog. Address Railroad Sales Division for your copy today.



**SCHRAMM** INC. **THE COMPRESSOR PEOPLE**  
**WEST CHESTER**  
**PENNSYLVANIA**

(Continued from page 72)

reported elsewhere in these columns, and **T. F. Maloney, Jr.**, on the engineer corps at New York, has been promoted to assistant supervisor of track on the Buffalo division at Rochester, succeeding Mr. Baerthlein.

### Special

**M. M. Stansbury** has been appointed supervisor maintenance of way shop and equipment of the New York, Chicago & St. Louis, with headquarters at Bellevue, Ohio, succeeding **C. G. Mitchell**, deceased.

### Bridge and Building

**James Frank**, assistant supervisor of bridges and buildings on the New York Central, with headquarters at Elkhart, Ind., retired recently after 44 years' service.

**Ernest B. Powell**, assistant engineer in the engineering department of the Louisville & Nashville, at Louisville, Ky., has been appointed assistant supervisor of bridges and buildings, with the same headquarters, succeeding **Frederick H. Boulton**, whose appointment as assistant engineer, bridge department, at Louisville, is reported elsewhere in these columns.

**Alexander Crawford**, whose retirement as bridge and building master on the Canadian National, with headquarters at Calgary, Alta., was reported in the November issue, was born at Oro, Ont., and entered railroad service in 1902 as a carpenter at St. Ann, Mass. He was promoted to foreman in 1904, and to bridge and building master in 1916, when he was transferred to Big Valley, Alta. In 1923 he was transferred to Calgary, where he remained until his retirement.

**George W. Benson**, supervisor of bridges and buildings on the Central of Georgia, at Macon, Ga., has been assigned to the chief engineer's office, with headquarters as before at Macon. **J. B. McKerley**, supervisor of bridges and buildings, with headquarters at Savannah, Ga., has been transferred to Macon, to replace Mr. Benson. **Stone Youngblood**, assistant supervisor of bridges and buildings at Savannah, has been promoted to supervisor of bridges and buildings, with the same headquarters, succeeding Mr. McKerley, and **Ralph Youngblood**, plumber at the Savannah terminals, has been promoted to assistant supervisor of bridges and buildings at Savannah, succeeding Stone Youngblood.

### Water Service

**Howard E. Graham**, water service inspector of the Illinois Central, at Chicago, has been promoted to assistant superintendent water service, Southern lines, with the same headquarters, succeeding to the duties of **W. B. Bryant**, who has retired after 45 years of service. **E. R. Schlaf**, supervisor water service, Iowa division—east, at Waterloo, Iowa, has been appointed assistant to superintendent water service, with headquarters at Chicago, succeeding to the duties of Mr. Graham. **W. O. Morris**, water service repairman, at

Clarksdale, Miss., has been appointed supervisor water service at Waterloo, succeeding Mr. Schlaf. **J. P. Hanley**, water service inspector, Northern lines, at Chicago, has been promoted to assistant superintendent water service, Northern lines, with the same headquarters.

### Obituary

**W. Pulford**, roadmaster on the Canadian National, with headquarters at St. Thomas, Ont., died recently.

**C. A. Lampard**, retired roadmaster on the London, Ont., division of the Canadian Pacific, died recently.

**Edward McCrea**, who retired in 1938 as roadmaster on the Canadian Pacific, at Sudbury, Ont., died recently at his home in Sault Ste. Marie, Ont., after a long illness. He was 66 years old.

**Harvey F. Hamilton**, who retired on December 31, 1940, as assistant to the chief engineer of the Great Northern, with headquarters at St. Paul, Minn., died on December 14.

**Louis Yager**, assistant chief engineer on the Northern Pacific, with headquarters at St. Paul, Minn., whose death on November 22 at the Northern Pacific hospital in St. Paul was reported in the December issue, was born at Germantown, Wis., on July 12, 1877, and received his higher technical training at the University of Minnesota. He entered railroad



Louis Yager

service in 1900 as a rodman on the Northern Pacific. From 1901 to 1902 he was assistant engineer on construction, and from 1902 to 1907 he was supervisor of bridges and buildings at Minneapolis, Minn. In 1907 he became assistant engineer on the St. Louis Bay bridge reconstruction at Duluth, Minn., and served in that capacity, and on construction at Glendive, Mont., until 1910, when he was appointed division engineer at St. Paul. Mr. Yager was appointed engineer maintenance of way in 1917, with the same headquarters. From 1919 to 1920 he served as chief maintenance of way engineer of the United States Railroad Administration, at Washington, D.C. In 1920 he returned to his post on the Northern Pacific, and in 1922 he was promoted to assistant chief engineer, the position he held at the time of his death.

## Association News

### Bridge & Building Association

On call by president F. G. Campbell, the Executive committee of the association met in Chicago on December 10. The principal work undertaken was the appointment of standing committees and the selection of personnel of the various technical committees to make reports at the annual meeting next September.

### Maintenance of Way Club of Chicago

The next meeting of the club will be addressed by T. B. Thompson, special engineer, signal department, Illinois Central, and for a number of years in charge of detector car operation on that road, on Development and Use of Detector Cars For Locating Hidden Rail Defects. For the second time, the meeting will be held in Harding's Restaurant on the 7th floor in the Fair Store, beginning with dinner at 6:30 p.m.

Daniel P. Loomis, executive director, Association of Western Railways, addressed the last meeting of the club on December 17, on The History and Results of Railway Labor Legislation. The meeting was attended by 124 members and guests.

### Metropolitan Maintenance of Way Club

At the next meeting of the club, which will be held on January 30 in the Skyline room of the Hotel Sheraton, New York, the guest speaker will be L. W. Horning, vice-president, personnel, New York Central. The meeting will begin with dinner at 6:30 p.m., and the program, in addition

(Continued on page 76)

### Meetings and Conventions

**American Railway Bridge and Building Association**—Annual meeting, September 16-18, 1947, Hotel Stevens, Chicago.

**American Railway Engineering Association**—Annual Meeting, March 18-20, 1947, Palmer House, Chicago.

**American Wood-Preservers' Association**—Annual meeting, April 22-24, 1947, Multnomah hotel, Portland, Ore.

**Bridge and Building Supply Men's Association**—Joint exhibit with Track Supply Association, September 15-18, Hotel Stevens, Chicago, during concurrent conventions of American Railway Bridge and Building Association and Roadmasters' Association.

**Maintenance of Way Club of Chicago**—Next meeting, January 27, Harding's at the Fair, 6:30 p.m.

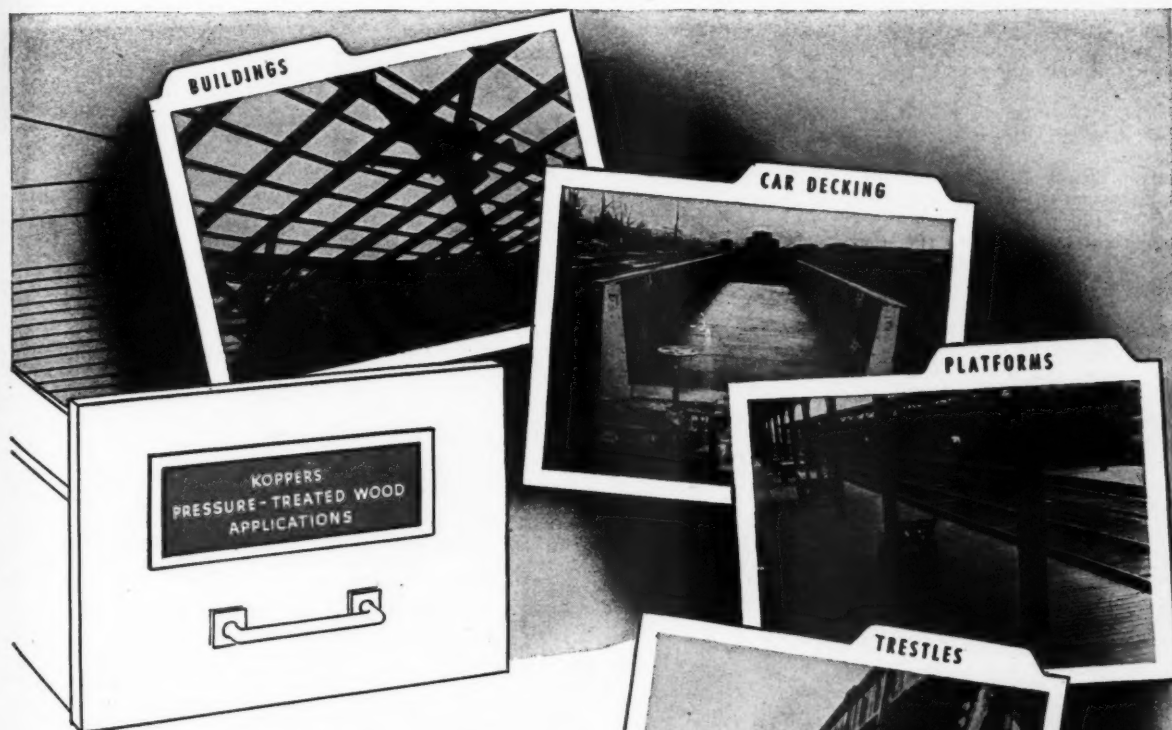
**Metropolitan Maintenance of Way Club**—Next meeting, January 30, Hotel Sheraton, New York.

**National Railways Appliances Association**—Thirty-second annual exhibit, Coliseum, Chicago, March 17-20, in connection with A.R.E.A. convention.

**Railway Tie Association**—Annual meeting, September 23-25, 1947, Arlington hotel, Hot Springs, Ark.

**Roadmasters' and Maintenance of Way Association of America**—Annual meeting, September 16-18, 1947, Hotel Stevens, Chicago.

**Track Supply Association**—Joint exhibit with Bridge and Building Supply Men's Association, September 15-18, Hotel Stevens, Chicago, during concurrent conventions of Roadmasters' Association and American Railway Bridge and Building Association.



## IF YOU'RE SEEKING SAVINGS-

*here's the place to look!*

No railroad Engineer today would think of using anything but pressure-treated ties for the construction or maintenance of ordinary track. Records show they give more than triple the service, save millions every year.

A lot of roads are making *added* savings by the use of pressure-treated wood in other applications. Users report more than three times the service from pressure-treated car decking . . . greatly extended life from pressure-treated running boards . . . less maintenance with pressure-treated platform lumber . . . longer-lasting, sturdier crossings with creosoted timber panel grade crossings . . . speedier, more economical construction of bridges and buildings through the use of pressure-treated wood . . . and an easy, permanent solution to foundation problems with pressure-treated lumber and piles.

Twenty-one Koppers treating plants are strategically located to serve you. Ask about the new developments . . . fire-retardent treatment, "Asid-bar\*" and others. Our bulletin, "Economical and Permanent Construction with Pressure-Treated Wood" gives complete information. Ask for it.



### PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PENNSYLVANIA

\*Trade Mark

Railway Engineering and Maintenance

January, 1947

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(Continued from page 74)  
to Mr. Horning's address, will include a motion picture entitled, "The Story of Slab 37."

The last meeting of the club, on December 12, at the Hotel Sheraton, was addressed by T. A. Blair, assistant chief engineer, Atchison, Topeka and Santa Fe system, who spoke on, "Roadbed Grouting." This meeting, which was held at noon, in conjunction with the annual dinner of the New York Railroad Club, was attended by 114 members and guests.

### Roadmasters' Association

The Executive committee of the association met in Chicago on December 9, with its principal business, the selection of the personnel of technical committees to undertake studies for report at the 1947 convention. The meeting was presided over by president E. J. Brown, who also made appointments to the standing committees of the association for the year.

### National Railway Appliances Association

Plans are progressing for the thirty-second annual exhibition of the association, to be held in the Coliseum, Chicago, March 17-20, in connection with the annual meeting of the American Railway Engineering Association. A large number of members have already contacted for exhibition space, and others desiring such space should contact the secretary of the association, C. H. White, 208 S. La Salle St., Chicago 4.

### Railway Tie Association

Looking ahead to its twenty-ninth annual meeting, to be held in the Arlington Hotel, Hot Springs, Ark., September 23-25, the executive committee of the association has appointed the following chairmen of technical committees to make studies and reports:

Checking and Splitting of Crossties—M. S. Hudson, Taylor-Colquitt Company, Spartanburg, S. C.

Legislative—B. N. Johnson, Wood Preserving Division, Koppers Company, Richmond, Ind.

Manufacturing Practice—T. J. Turley, Jr., Bond Bros., Inc., Louisville, Ky.

Mechanical Handling of Ties—F. C. Jones, T. J. Moss Tie Company, St. Louis, Mo.

Timber Conservation—P. D. Brentlinger, Pennsylvania, Philadelphia, Pa.

Concentration Yards Operations—John Wright, Wood Preserving Division, Koppers Company, Carbondale, Ill.

Specifications—Leonard Perez, Wood Preserving Division, Koppers Company, St. Louis, Mo.

### American Railway Engineering Association

Only two standing committees held meetings in December, these being the Committee on Track, which met at Chicago on December 5, and the Committee on Impact and Bridge Stresses, which met on December 3, also at Chicago. Only one committee has scheduled a meeting for January, this being the Committee on Masonry which will meet at St. Louis, Mo., on January 15 and 16.

The report of the Nominating committee was received at a recent meeting of the Board of Direction. As a result of the action of the committee the following names will appear on the ballot, which will be mailed to members about February 1:

President, Armstrong Chinn, president, Terminal Railroad Association of St. Louis, St. Louis, Mo.; vice-president, F. S. Schwinn, assistant chief engineer, Missouri Pacific Lines, Houston, Tex.; directors (three to be elected), H. S. Loeffler, assistant chief engineer, Great Northern, St. Paul, Minn.; W. J. Hedley, assistant chief engineer, Wabash, St. Louis, Mo.; C. G. Grove, chief engineer maintenance of way, Western region, Pennsylvania, Chicago; W. D. Simpson, chief engineer, Seaboard Air Line, Norfolk, Va.; T. A. Blair, assistant chief engineer system, Atchison, Topeka & Santa Fe, Chicago; W. G. Powrie, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific, Chicago; R. J. Gammie, chief engineer, Texas & Pacific, Dallas, Tex.; F. G. Campbell, assistant chief engineer, Elgin, Joliet & Eastern, Joliet, Ill.; and A. N. Laird, bridge engineer, Grand Trunk Western, Detroit, Mich.

For members of the Nominating committee (five to be elected): A. B. Chapman, engineer and superintendent bridges and buildings, Chicago, Milwaukee, St. Paul & Pacific, Chicago; J. E. Bernhardt, bridge engineer, Chicago & Eastern Illinois, Chicago; W. J. Strout, chief engineer, Bangor & Arrostook, Houlton, Me.; G. W. Miller, district engineer, Canadian Pacific, Toronto, Ont.; H. G. Carter, engineer maintenance of way, Central of Georgia, Savannah, Ga.; A. B. Stone, assistant chief engineer, Norfolk & Western, Roanoke, Va.; E. C. Vandenberg, chief engineer, Chicago & North Western, Chicago; V. R. Walling, assistant chief engineer, Chicago & Western Indiana, Belt Railway of Chicago, Chicago; C. J. Code, engineer of tests—maintenance of way, Pennsylvania, Altoona, Pa.; and W. E. Heimerdinger, acting assistant chief engineer, Chicago, Rock Island & Pacific, Chicago.

In addition to the above names to be balloted on, C. H. Mottier, vice-president and chief engineer, Illinois Central, who was recently appointed junior vice-president to fill a vacancy, will automatically be advanced to senior vice-president at the time of the election in March, 1947.

Bulletin 462 (November, 1946) has been in the hands of members for several weeks. Bulletin 463 (December), to be mailed to members around the end of the month, will contain the reports of the Committees on Buildings, Wood Preservation, Economics of Railway Labor, Maintenance of Way Work Equipment, Ties, and Water-proofing.

**Let's Organize That Gang**—This is the title of a 32-page booklet published by the Electric Tamper & Equipment Co., Ludington, Mich. Included are several suggested organizations for track gangs when equipped with Jackson ballast-placing equipment, manufactured by this company. This booklet also contains complete descriptions of several methods of track raising and surfacing, using different combinations of Jackson equipment, and is illustrated with diagrams showing recommended arrangement of the tamping tools. A discussion of types of ballast and a table showing the recommended tamping blade for each are also included. The booklet is especially intended for the use of section and extra-gang foremen.

## Supply Trade News

### General

**Drinkwater, Inc.**, Chicago, has transferred its headquarters to Spring and Madison streets, Waukegan, Ill.

The **Independent Pneumatic Tool Company**, 600 West Jackson boulevard, Chicago 6, has announced a \$1,000,000 expansion of its main works at Aurora, Ill. Construction of the annex, which will provide 85,000 sq. ft. of additional floor space, will begin shortly.

The **R. C. Larkin Company**, 3001 South Wabash avenue, Chicago, distributor in the Chicago area for the industrial power units manufactured by the **International Harvester Company**, Chicago, now has the full industrial power contract for this company, which includes the contract covering the railroad industry, in the Chicago area.

**R. G. LeTourneau, Inc.**, Peoria, Ill., has announced it now has in production a new small self-loading Tournapull having a struck capacity of 3½ yd., a size said to be especially suitable for certain railway off-track maintenance jobs, such as drainage improvement, and as a one-man utility dirt mover. An illustrated article describing this new product will be published in the February issue of *Railway Engineering and Maintenance*.

The **American Lumber and Treating Company** has announced plans for the construction at Everett, Wash., of a large plant capable of chemically processing more than a million board-feet of lumber a month. The output of the new plant will consist of wood treated to resist fire, rot, and insects. The plant itself will cover seven acres adjacent to the mill of the Weyerhaeuser Timber Company, and chemical processing facilities will be operated for that company and other members of the Pacific Northwest lumber industry. Operations will include the treatment of lumber with Wolman salts, creosote, and Minalith flameproofing salts. The installation will include two huge steel vacuum-pressure treating cylinders, each capable of handling approximately a carload of timber at one time.

### Personal

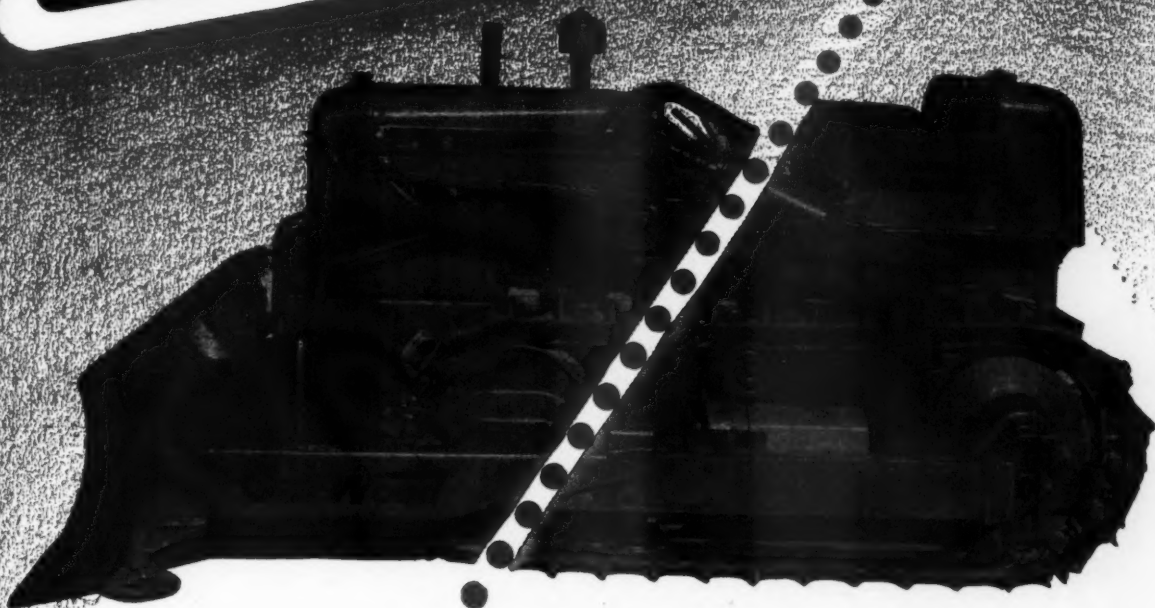
**Francis J. Wakem** has been appointed vice-president of the **Johns-Manville Sales Corporation**, at New York. Mr. Wakem will also continue as merchandise manager of the industrial products division.

The **Link-Belt Company**, Chicago, has announced the opening of a sales office at 808 North Third street, Milwaukee 3, Wis. **Williard M. Hufnagel**, district sales manager, has been placed in charge of the new office, and will be assisted by **H. B. Johnson** and **F. E. Sweeney**.

**John B. Caldwell** has been appointed chief engineer of the **Blackmer Pump Company**, Grand Rapids, Mich., and **L. R.**

(Continued on page 78)

PERFECTLY MATCHED



**FOR THE BRAND NEW  
ALLIS CHALMERS HD-5 TRACTOR**

**Specially Designed and Balanced Equipment by**

When it comes to real, down to earth engineering in small packages . . . you just can't beat the brand new, specially designed and balanced Gar Wood Equipment for the new Allis Chalmers HD-5 Tractor.

For here is a combination that's engineered and built expressly for years of dependable, rugged, smooth-functioning

work. Perfectly-balanced earth-moving brawn that means more profit to you! And what's more . . . it's a combination that's built to take a beating . . . under the worst possible conditions . . . on the toughest jobs!

Want proof? Ask the men who've been using Gar Wood Road Building Equipment all over the world. Ask them about

**GarWood**

Gar Wood quality and dependable operation when and where it counts. Then consider: this is newly designed, exactly-engineered, quality-built Gar Wood Equipment.

And then . . . for your own good . . . specify Gar Wood!



**ROAD MACHINERY DIVISION  
WAYNE, MICHIGAN**



## Inland 4-Way Floor Plate Safe . . . Strong . . . Durable

One glance at Inland 4-Way Floor Plate will quickly show you how the raised projections prevent slipping and falling. These scientifically designed lugs are just the right shape for maximum safety yet prevent catching heel or toe in any size pattern.

In your plant or installed on your equipment, 4-Way Floor Plate means added safety, employee confidence and smart design. You'll find it on floors, walkways, steps, ramps, platforms, running boards, decks, hatch covers, and anyplace where dangerous slips and falls might occur.

Inland 4-Way is provided in three pattern sizes (Large, 1 $\frac{1}{4}$ "; Medium, 1"; Small,  $\frac{5}{8}$ ") and thicknesses from 18 gage up to  $\frac{1}{2}$ ".

Available now from leading steel warehouse distributors. Write for catalog.

✓ Check these advantages against the flooring you are now using:

- ☐ Safe for foot or wheel
- ☐ Carries the heaviest of loads
- ☐ Lasts for years and years
- ☐ Cleans easily, drains freely
- ☐ Convenient to cut, form or weld
- ☐ Matches and installs with ease

### INLAND STEEL COMPANY

38 S. Dearborn Street

Chicago 3, Ill.

Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

(Continued from page 76)

DeWolf and V. A. Brunson have been appointed senior engineers, as part of an expansion program in the engineering department for development work on rotary pumps.

Clinton T. Hallsted, assistant sales manager of the American Lumber & Treating Co. at 604 Mission street, San Francisco, Cal., has been appointed manager, with the same headquarters, succeeding Marx Hyatt, who has resigned.

James G. Lyne has been appointed to the new office of assistant to chairman of the Simmons-Boardman Publishing Corporation, publisher of *Railway Engineering and Maintenance*, with such authority and duties as the chairman shall give him. He will continue as heretofore to be vice-president of the corporation and assistant



James G. Lyne

to the editor of *Railway Age*. Mr. Lyne was born at St. Louis, Mo., on July 10, 1898. He grew up at Herington, Kan., where his father was a conductor on the Chicago, Rock Island & Pacific. He was educated at the University of Kansas (A.B. 1920) and New York University (Ph. D. 1946). He entered railway service in 1914 as a laborer in the car department of the Rock Island at Herington and served for fifteen months in that capacity, and as material clerk, timekeeper, file clerk, and M. C. B. clerk. He worked during summer vacations when at college for the Rock Island as extra gang timekeeper, rodman, ballast inspector and extra clerk in the office of the superintendent at Herington and in the general roundhouse foreman's office at Kansas City, Kan. He was special agent of the Bureau of Labor Statistics, Washington, D.C., 1919-1920, and a reporter on the New York Daily News in 1920. He was an associate editor of *Railway Age*, 1920-1928, financial editor, 1928-1938, has been assistant to the editor of *Railway Age* since 1938, and vice-president and director of the Simmons-Boardman Publishing Corporation since 1943.

J. J. Desmond, formerly a division engineer on the Illinois Central, has been appointed a representative for the Morrison Railway Supply Corporation, Buffalo, N.Y., in the Chicago territory. Mr. Desmond will contact the railroads in this

(Continued on page 80)



## ONE MAN-TWO MAN SAWS ... with the SAME engine!

CLIP AND MAIL COUPON NOW!

Reed-Prentice Corporation  
Timberhog Saw Division, Dept. R.  
Worcester 4, Massachusetts

Please send folder and name of nearest distributor handling the Timberhog portable one and two man gasoline engine chain saws.

NAME .....

ADDRESS .....



MANUFACTURERS OF GASOLINE,  
AIR AND ELECTRICALLY DRIVEN  
CHAIN SAWS

**R**EED-PRENTICE Timberhog gasoline powered chain saws are 5 times as fast as hand cutting — will go where you go and do what you want — bucking, limbing and felling in remote sections with speed and dependability!

The 2 cycle, 4 H. P. gas engine is economical to operate — has positive fuel injection — is lightweight — has power to spare for all models — 20 inch, 24 inch or 30 inch capacities.

The one man 20" Timberhog for light cutting and general maintenance work weighs only 52 lbs. and can be quickly converted for two man operation with a helper's end. The 24" two man (54 lbs.) and the 30" two man (57 lbs.) are effective for heavier timber, and a multitude of uses in the railway, mining, paper and other industries where power sawing is essential.



Burro Locomotive Cranes meet the specific need for a fast, mobile, multi-purpose crane that can handle large or small maintenance-of-way or yard jobs with the same economy. No matter what the work calls for — clamshell bucket, rail tongs, hook, magnet or dragline, the Burro is ready to deliver the same efficient, cost-saving performance that have made it the preferred locomotive crane.

### Only Burro has all these features:

- Fast travel speeds—up to 22 m.p.h.
- Draw Bar Pull of 7500 lbs. (often eliminates need for work train or locomotive.)
- Elevated Boom Heels for working over high sided gondolas.
- Short tail swing—will not foul adjoining track.
- Low overall height—Burro can be loaded and worked on a standard flat car.

**CULLEN-FRIESTEDT CO.,**  
1301 S. KILBOURN AVE. CHICAGO, ILLINOIS

**LARGE**  **or small**

**BURRO DOES EVERY JOB  
EFFICIENTLY, ECONOMICALLY**

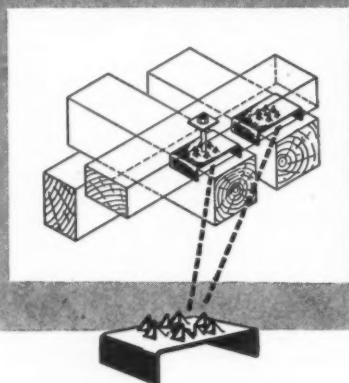
Whether the Burro is used to speed track laying or relocation, for bridge building, earth or ballast handling or on locomotive coaling jobs, it will handle every job more efficiently and economically—because Burro Cranes are built for railroad work.



# TECO

## CLAMPING PLATES

*tie 'em down*



Use TECO clamping plate timber connectors for rigidly attaching ties to guard timbers with low maintenance cost.

Bolts are used in every third or fourth tie with lower replacement costs.

Write for FREE design data for using clamping plates.

### TIMBER ENGINEERING COMPANY

1319 18th St., Washington 6, D. C.

Please mail me free design data for using Teco Clamping Plates.

Name \_\_\_\_\_

Company \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

REM

(Continued from page 78)

territory in connection with the various track devices manufactured by the Morrison Railway Supply Corporation, and will also represent this company on certain railroads in connection with the repairing, reinforcing or reconstruction of steel bridges and the maintenance welding of frogs and crossings.

R. C. Todd, G. F. Ahlbrandt, and Dr. Anson Hayes have been elected vice-presidents of The American Rolling Mill Company.

Frederick J. Lindauer, formerly assistant manager, has been appointed manager of Fairbanks, Morse & Co.'s Washington, D.C., office to succeed the late Robert E. Post.

Frederic E. Lyford has been elected president and a director of the Merritt-Chapman & Scott Corp., construction and marine salvage engineers and contractors. Formerly assistant to the chairman of the board, he succeeds L. L. Smith, who has retired after 40 years as president of the organization.

Born in Waverly, N.Y., on January 20, 1895, Mr. Lyford was graduated from Cornell university in 1916 with a degree in mechanical engineering. Employed suc-



Frederic E. Lyford

cessively by the Bethlehem Steel Company as an apprentice ship fitter at Sparrows Point, Md., and by the Allied Machinery Company as a factory inspector at New York, he served with the U. S. Army during the first world war with the rank of first lieutenant and was attached to the air service as an observer. He rejoined Allied Machinery in 1919 as assistant sales manager at New York, and in 1920 entered sales promotion work for the Tioga Mills at Waverly. Mr. Lyford's railroad career began in 1923, when he joined the Lehigh Valley as an apprentice instructor at Sayre, Pa. Promoted to assistant general machine foreman two years later, he was appointed special engineer to the superintendent of motive power at Sayre in 1928, shortly after which he was made special engineer to the vice-president there. He served as examiner for the railroad division of the Reconstruction Finance Corporation from 1934 to 1936, when he was appointed assistant to the vice-president of the Baldwin Locomotive Works. Appointed trus-

tee of the New York, Ontario & Western in 1937, Mr. Lyford resigned that position on December 1, 1944, to join Merritt-Chapman & Scott as assistant to the chairman of the board, holding that position until his recent promotion.

Dr. C. Earl Webb, western division engineer of the American Bridge Company (a subsidiary of the United States Steel Corporation), at Chicago, has been appointed chief engineer, with headquarters at Pittsburgh, Pa., succeeding Dr. Charles F. Goodrich, who has retired after 40 years of service with the company. Albert P. Boysen, engineer in charge of design at Chicago, succeeds Dr. Webb as western division engineer with headquarters at Chicago.

The Wood Preserving Division of Koppers Company, Inc., has announced the following appointments: Walter P. Arnold, formerly manager of the technical department, has been appointed assistant to the vice-president, in charge of railroad sales, with headquarters at Pittsburgh, Pa.; J. M. Irvine, formerly district sales manager at New York, has been appointed assistant to the vice-president, in charge of commercial sales, with headquarters at Pittsburgh; R. H. Bescher, a member of the technical staff since 1930, has been appointed manager of the technical department, with headquarters as before at the Division's technical laboratory at Orrville, Ohio.

### Obituary

Charles D. Young, sales manager of the Metal & Thermit Corporation, died on November 16, in the Memorial Hospital at Orange, N.J. Mr. Young was born at Charles City, Iowa, on June 30, 1888, and received his higher education at Armour Institute of Technology, Chicago. He joined the Metal & Thermit sales organization in 1911, and in 1930 he was appointed district sales manager at Chicago. In 1943 he was advanced to sales manager, with headquarters at New York. Mr. Young was a vice-president of the National Railway Appliances Association, having served for a number of years on its board of directors. He was also a member of the Executive committee of the Chicago section of the American Welding Society.

### Wanted—Associate Editor

Railway Engineering and Maintenance has a position open on its editorial staff for a man with an engineering education and practical experience in railway engineering and maintenance of way work. Good personality, under 30 years of age, technical degree, at least three years of practical experience, and a leaning toward reportorial work. Must demonstrate ability to write English clearly and concisely. Headquarters New York, following training period in Chicago. Address Railway Engineering and Maintenance, 105 West Adams street, Chicago 3, Ill.

# Song of the Open Road —by JORDAN

Music to the ears of maintenance and operating men is the way the powerful, dependable JORDAN Snow Plow whips the snow blockades—bucks deep drifts out of cuts; and with huge wings spread wide, clears two, even three, tracks at once to free tied-up classification yards.

An ideal all-year "mechanical crew"—essential in dry weather for shaping ballast and banks, spreading fill, cleaning ditches—saves countless man-hours. Write for 100-picture catalog.

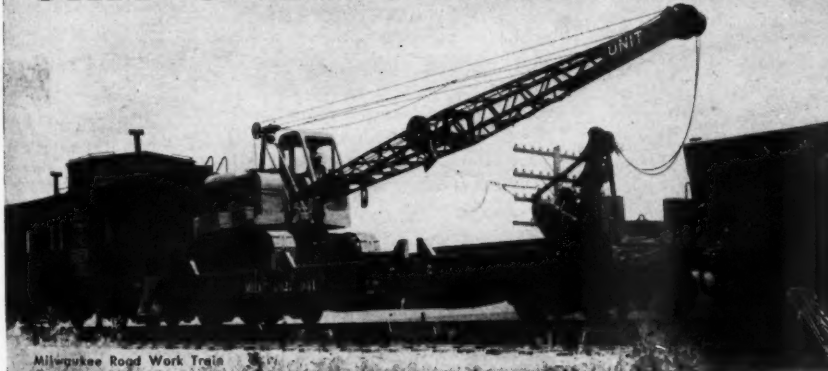


## O. F. JORDAN COMPANY

WALTER J. RILEY, President

EAST CHICAGO, INDIANA

## UNIT CRANES "Tailor-made" for Railroad Jobs



Milwaukee Road Work Train

Something unusual in construction is this flat car crawler crane carrier. It consists of guide angles laid lengthwise along top of car to form a runway for the crawlers. Machine can travel full length of car without danger of running off. The car is divided into three sections which act as operating positions as the work progresses. Crossbeam dividers can be inserted as stabilizers while the machine is in operation, or when the entire train is moving.

### Mobile UNITS for Yard Work

UNIT 357 Mobile Crane is self-propelled... Rides on rubber... Ready for action with a push on the starter... Travels anywhere... gets there in a hurry. Fully convertible to all attachments... Operated by ONE man... Powered by ONE engine... Controlled from ONE position in UNIT's safety promoting FULL VISION CAB.

1/2 and 3/4 Yd.  
Excavators

5 and 10 ton  
Cranes



CONTACT FACTORY DIRECT  
for Price and Delivery!



## UNIT CRANE & SHOVEL CORP.

6403 WEST BURNHAM STREET  
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# RAILROADS USE BLAW-KNOX BUCKETS

... for bulk transfers at docks and terminals, cooling, ballast cleaning, ditching, hard digging, and ash handling.

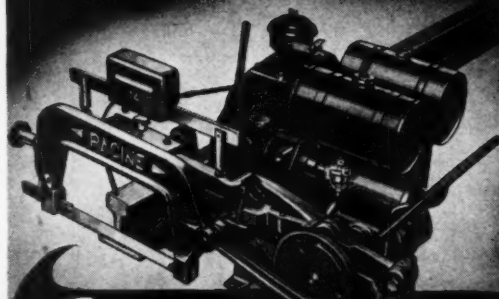
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*Proper selection  
of the right  
Bucket is now  
an easy job.*

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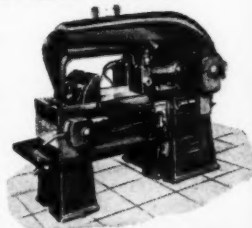
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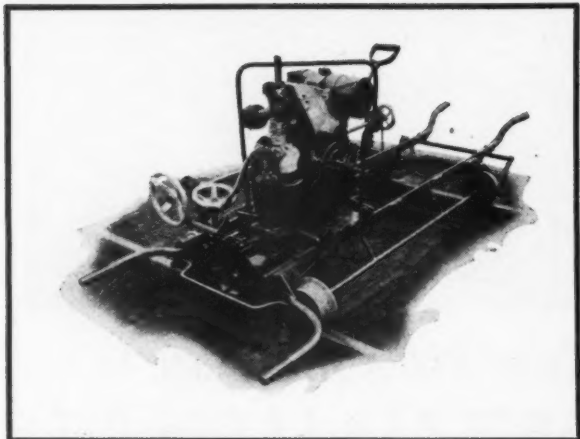
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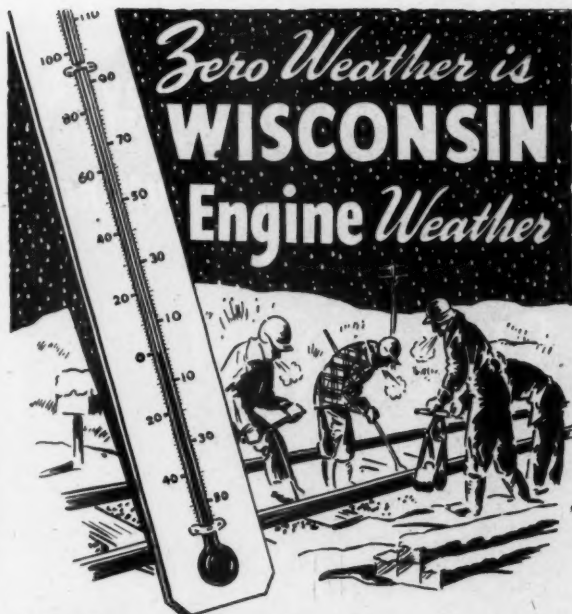
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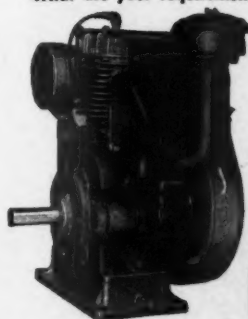


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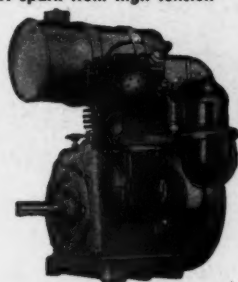
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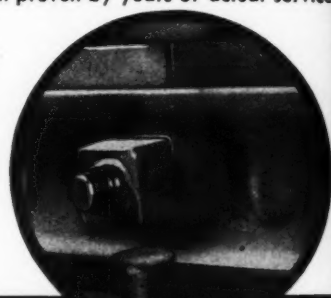
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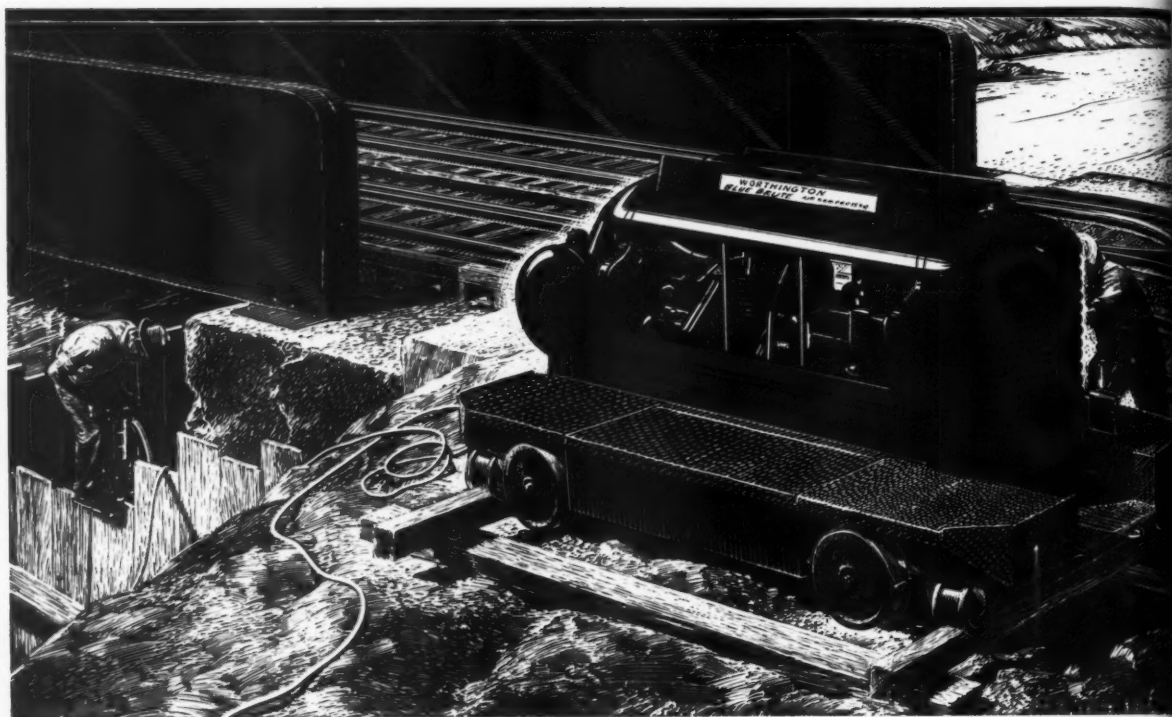
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